



Republic of Armenia

Road Department
State Non-Commercial Organization
SNCO

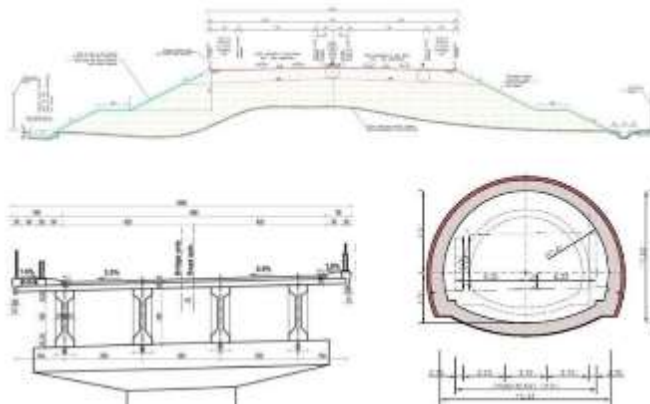


Eurasian Development Bank - EDB
North-South Road Corridor Investment Program
Tranche 4

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

PREPARATION OF DETAILED DESIGN, LAND ACQUISITION AND RESETTLEMENT PLAN OF ABOUT 32 KM ROAD FROM AGARAK TO TUNNEL EXIT; AND PREPARATION OF DETAIL DESIGN, LAND ACQUISITION AND RESETTLEMENT PLAN ON ABOUT 7 KM FROM TUNNEL ENTRANCE TO KAJARAN AND ABOUT 6 KM OF THE TUNNEL AND ACCESS ROADS (TRANCHE 4)

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FEBRUARY 2022

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CONTRACT INFORMATION AND REFERENCES

Project Name:	Preparation of detailed design, land acquisition and resettlement plan of about 32 km road from Agarak to tunnel exit; and preparation of detail design, land acquisition and resettlement plan on about 7 km from tunnel entrance to Kajaran and about 6 km of the tunnel and access roads (tranche 4)
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ABBREVIATIONS AND DEFINITIONS

AP - Affected Person
REA - Rapid Environmental Assessment (checklist)
ADB - Asian Development Bank
EDB – Eurasian Development Bank
ERT - Emergency Response Team
USD - United States of America Dollar
SPS - Safeguard Policy Statement (2009)
GRM - Grievance Redress Mechanism
EIA - Environmental Impact Assessment
EMP - Environmental Management Plan
ES - Environmental Specialist
RD - Road Department SNCO
ME - Ministry of Environment
EA - Executing Agency
IA - Implementing Agency
PMU - Project Management Unit
NGO - Non-governmental organization
RA - Republic of Armenia
AM - Accountability Mechanism
LARP - Land Acquisition and Resettlement Plan
MESCS - Ministry of Education, Science, Culture and Sport



EIA - Environmental Impact Assessment
EIEC - Environmental Impact Expertise Centre” SNCO
IPMIB – Environmental protection and Mining Inspection Body
MTAI - Ministry of Territorial Administration and Infrastructure
HSE - Health, Safety & Environment
MOEDI - Ministry of Economic Development and Investment
NGOs - Non-government organizations
SEMP Site-Specific Environmental Management Plan
SNCO - State Non-commercial Organization
TOR - Terms of Reference

WEIGHTS AND MEASURES

dB(A)	Decibel (A-weighted)
km	Kilometer(s)
km ²	Square kilometer(s)
l	Liter
m	Meter(s)
mg/m ³	Milligram(s) per cubic meter



1. EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND

The Republic of Armenia and the Eurasian Development Bank (EDB) out of Eurasian Fund for Stabilization and Development signed Loan Agreement to implement the North-South Road Corridor Investment Program (Project), - Tranche 4 – Section Kajaran/Agarak (south part- Iranian Border).

The Ministry of Territorial Administration and Infrastructure of Republic of Armenia is responsible for the overall management of the Project.

“Road Department” SNCO was appointed as the Project Implementation Unit (PIU) acting under the Agency Agreement signed with the Ministry of Territorial Administration and Infrastructure of Republic of Armenia.

“North-South Road Corridor Investment Program” is a major infrastructure project (NSRCIP project) which aims at connecting the Southern border of the Country with its Northern point by means of 556 km-long Meghri-Yerevan-Bavra highway by reducing it about 85 km and reaching up 470 km.

North South Corridor is also a part of the Asian Highway corridor (AH 82) which is a road in the Asian Highway Network running 1265 km from Leselidze, Georgia to Ivughli, Iran.

As a result, the reconstruction of the current road of 556km of the 2nd category with the average of 60km/h will reach to 470km road with 100km/h (where possible) as a result of which the crossing of the mentioned section will decrease from current 9-9.5 hours up to 4.5 hours and will increase comfort and safety, ensuring also the Goal of becoming a transit route of freight and transport movement from North to South.

The construction of this highly important strategic road will ensure easier traffic from the Southern border of Armenia to the Georgian border and up to Black Sea ports and will allow passenger and cargo transportation in accordance with European standards. The highway will also provide serious development opportunities for all communities from the North to the South of Armenia.

Eventually, NSRCIP project implementation will result in the following outcomes:

- Improved road corridor in compliance with international standards;
- Four-lane Category 1 road on Yerevan-Gyumri and Yerevan-Ararat sections;
- Other road sections meeting international standards with the possibility to be widened up to four-lane road in the future;
- Efficient and safe road corridor traffic management.

NSRCIP project objectives: facilitating communication with neighbouring countries; expanding and facilitating access to foreign market towards Central Asia and Europe; developing major economic spheres and export



expansion (industry, agriculture, mining industry, construction, tourism), the activation of the internal movement of population etc.

Main Goals: improving traffic safety and comfort, reducing time and financial costs, integrating possible necessary telecommunication and other infrastructures.

North-South Road Corridor will:

- Provide access to the Black Sea through the territory of Armenia and Georgia and then to European countries;
- Cross the territory of Armenia from the South to the North (Meghri – Yerevan – Ashtarak Gyumri - Bavra) the corridor connects to the Georgian road leading to Poti and Batumi ports;
- Results in improving Europe - Caucasus – Asia road communication at the intersection of West Asia and East Europe

NSRCIP project is implemented in the context of the following RA Government projects: "Reconstruction of Gyumri techno city", "Tatev tourist center", "Development of Jermuk town" and "Zvartnots free economic zone". The implementation of North-South Road Corridor will significantly contribute to the efficiency of the mentioned projects and to the achievement of program Goals.

Contracts/Agreement have been signed with the Asian Development Bank (ADB), European Investment Bank (EIB), and Eurasian Fund for Stabilization and Development (EDB), for the implementation of the Project and the target completion dates are 2017, 2018 and 2019 respectively. Negotiations continue to be conducted for involvement of other donors for the construction of northern and southern parts of the corridor and new financial sources have been investigated for involvement of funding in scope of public-private partnership (PPP) and private investors.

The Project, with estimated cost of 1.5 billion USD, is divided into 6 Tranches and separate loan agreements are signed in the framework of each Tranche.

Tranche 1: consists of two road sections. One to the south (Yerevan-Artashat, section 2) 19.6 km length and the second to the north (Yerevan - Ashtarak, section 3) 11.4 km length. On this part of the road the following major tasks to be accomplished were: reconstruction of the road pavement with Portland cement-concrete surface, repair of artificial structures and culverts.

Tranche 2: consists of one road section to the north (Ashtarak - Talin, section 1) 41.9 km length. This road is of an II technical class and maintains 2 opposite traffic lanes. After reconstruction this road section expected to be I technical class. This part of the road will have about 12.5 km of the new alignment and about 26.7 km of the existing alignment, mostly widening the existing road bed.

Tranche 3: consists of two road sections: Talin - Lanjik (km 71+500 - km 90+200) 18.7 km length and the second section Lanjik - Gyumri (km 90+200 - km 117+670) 27.47 km length. This road is currently an II technical class and has 2 opposite traffic lanes. After reconstruction this road section is expected to be I technical class. The



first part of the Tranche 3 is implemented with the support of Asian Development Bank and the second part is implemented with the support of European Investment Bank.

Tranche 4: is the southern part of the North-South corridor. It begins from the town of Artashat and ends at the mutual border between the Republic of Armenia and the Islamic Republic of Iran. Tranche 4 consists of 3 main parts: Artashat-Sisian, Sisian-Kajaran and Kajaran-Agarak.

Tranche 5: is a northern part of the North-South Corridor. It begins from the town of Gyumri and ends at the mutual boarder between the Republic of Armenia and Georgia. Tranche 5 consists of 2 parts: the first one is the bypass of the town Gyumri and the second one reaches the country border.

Tranche 6: is the south-western bypass road of Yerevan which should connect second and third parts of the Tranche 1, including southern and northern parts of the North-South Road Corridor.



Figure 1: North-South Road Corridor Investment Program

The implementation of project was started in both directions from Yerevan. In frame of **Tranche 1, Tranche 2 and Tranche 3** currently 119 km total length of the road either under the construction or operation phases: From Yerevan to South (Artashat) -19,6 km and from Yerevan to North (Gyumri)-99,4 km.

Tranche 4





Tranche 4 is the southern part of the North-South corridor and it consists of 3 main parts and 8 subsections in total. It begins from the town of Artashat and ends at the mutual border between the Republic of Armenia and the Islamic Republic of Iran.

Tranche 4 is implemented by the financing of two international banks: Asian Development Bank (ADB) and Eurasian Development Bank (EDB):

Asian Development Bank

- Feasibility study of about 304 km from Artashat to Kajaran road section
- Preliminary design of about 304 km of Artashat to Kajaran road section
- Detailed design of about 60km from Sisian to Kajaran
- Feasibility Study of about 55 km of the existing road (Kajaran-Agarak section of M2 road from km 328+600 to km 384+000)

Eurasian Development Bank out of Eurasian Fund for Stabilization and Development

- Preliminary and Detail design of about 45 km from Kajaran to Agarak
- Author Supervision for 32 km of the above mentioned 45 km (the second part, close to Iranian Border).

Feasibility study for Tranche 4: Section Kajaran-Agarak(hereinafter Project) has been finalized by EGIS International in 2014 and the design of the Project is implemented by J/V IRD ENGINEERING S.R.L. and GP Ingegneria S.R.L companies under the contract No.: T4-CS-01-D “Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 32km Road from Agarak to Tunnel Exit; and Preparation of Detail Design, Land Acquisition and Resettlement Plan on about 7km from Tunnel Entrance to Kajaran and about 6km of the Tunnel and Access Roads (Tranche 4)”. The preparation of draft and final EIA and EMP for Kajaran-Agarak road section is a contractual obligation, that should be done based on preliminary and design of that road section including full field surveys (topography, geology, biodiversity and etc.).

1.2 RESPONSIBLE ENTITY

The Project is being implemented by the Ministry of Territorial Administration and Infrastructure. “Road Department” SNCO (hereinafter RD) was established by the Decree No 1304-A of the Government of the Republic of Armenia as of 15 December 2016 through reorganizing and merging of “Transport Projects Implementation Unit” State Institution and “North-South Road Corridor Investment Program Implementation Organization” State Non-Governmental Organization. The Organization is considered to be the legal successor of “Transport Projects Implementation Unit” State Institution and “North-South Road Corridor Investment Program Implementation Organization” State Non-Governmental Organization. “Road Department” SNCO has been designated as the implementing entity for the Project, responsible for the management and day-to-day activities of all the Project components and for the management of all funding sources and mechanisms in relation to and in the framework of the Project.



1.3 SCREENING AND CLASSIFICATION

Tranche 4, 45km Kajaran-Agarak road section, under the North-South Road Corridor Investment Project has been screened with the ADB's Rapid Environmental Assessment Checklist (REA). The classification was based on the most environmentally sensitive component of the project, which means that if one part of a project has the potential for significant adverse environmental impacts, then the project is to be classified as environmental category "A" regardless of the potential environmental impacts of other aspects of the project. Based on the REA Checklist, the project is classified as a Category "A". According to the Armenian legislation a proposed project is classified as a Category "A" and an EIA report according to Armenian legislation is needed. As already mentioned, this project is funded by the EDB, and the preparation of the EIA report was based on the requirements of the ADB SPD (2009) policy and Armenian legislation.

1.4 REPORT, METHODOLOGY AND SCOPE OF THE STUDY

This study was carried out in accordance with the ADB Security Policy Document (SPD, 2009), the Environmental Impact Assessment Guide (2003), and the Environmental Assessment Assessment Framework (EIA), agreed with the Government and the EDB. If the local standards are absent or not enough, international standards and guidelines are taken as main. This includes the World Bank's General Environmental, Health and Safety Guidelines (2007).

The environmental assessment and preparation of the report and Environmental Management Plan (EMP) includes the following major activities:

- (i) Gathering of baseline information on the physical, ecological, and socio-cultural and economic environment of the Project area and understanding the technical, social, and institutional aspects (desk study during the preliminary design phase and site surveys during final design preparation phase);
- (ii) Discussions with specialists of RA Ministry of Environment, RA Ministry of Territorial Administration and Infrastructure, other relevant official authorities; Organization of public consultation events during the final design preparation phase;
- (iii) Identification of impacts, concerns and other potential issues, related to the location, design, construction, and operation to distinguish those that are likely to be significant;
- (iv) Preparation of Environmental Management Plan (EMP) indicating impact areas, recommended mitigation measures, methods of monitoring the impacts, responsible agencies/persons, and associated costs; and
- (v) Proposing the institutional set-up for implementation of the EMP.

The Structure of this EIA report follows the following outline:

- Executive Summary,
- Policy, Legal and Administrative Framework,



- Project Description,
- Description of the environment (baseline data),
- Anticipated environmental impacts and mitigation measures,
- Analysis of alternative,
- Information Disclosure, Consultation and Participation,
- Grievance Redress Mechanism,
- Environmental management plan (mitigation and monitoring),
- Conclusion and Recommendations,
- Annexes.

The report was also prepared in both Armenian and English languages.

Baseline data and other information were obtained from published and unpublished sources including climate, topography, geology and soils, natural resources, flora and fauna and socio-economic data.

2. LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 ADB ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Safety policy document (2009) requires an environmental impact assessment for all programs supported by ADB, but the basis for the environmental impact assessment was the Security Policy Document proposed by ADB for all projects (2009). At an early stage of program preparation, the policy also requires that possible risks and their significance be clarified through communication with beneficiaries, individuals with influence as a result of the program, public organizations, relevant ministries, and public consultations. If possible negative environmental impacts and risks should be identified, an environmental impact assessment should be carried out as soon as possible. The assessment should take into account all stages of the program, including construction and operation, and effects should be prevented where mitigation measures are possible or proposed.

2.2 ARMENIAN LAWS, GOVERNING ENVIRONMENTAL MANAGEMENT AND ASSESSMENT

In 1991, after independence, the environmental concerns became political priorities and the process of development of environmental legislation was initiated. Environmental concerns became a priority political issue, and a legislative framework for the environment was formed. The 10th Article of the Constitution of the Republic of Armenia (adopted in 1995 and amended in 2005) stipulates that the State is responsible for environmental protection, reproduction and wise use of natural resources. Since 1991 more than 33 codes and laws as well as numerous by-laws and regulations have been adopted to protect the environment. The relevant national law on environmental impact assessment and protection is the follow:

- ✓ Law on Environmental Impact Assessment and Expertise (June 22, 2014).



The mentioned legislation is the basic law, which is applied and used by the ME. It is also necessary to take into account the following components of the relevant environmental legislation:

- Law on Specially Protected Areas (1991, updated in 2006),
- Law on Ensuring Sanitary-epidemiological Security of the RA Population (1992);
- Law on Atmospheric Air Protection (1994);
- Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998);
- Law on Environmental and Nature Use Charges (1998);
- Law on Flora (1999);
- Law on Fauna (2000);
- Land Code (2001);
- Law on Hydrometeorological Activities (2001);
- Law on Environmental Education (2001);
- Subsoil Code (2002);
- Water Code (2002);
- Law on Seismic Protection (2002),
- Law on Wastes (2004);
- Law on Water Users' Associations and Companies (2002);
- Law on Environmental Oversight (2005);
- Forest Code (2005);
- Law on Rates of Environmental Charges (2006);
- Law on Transport (1998);
- Law on Automobile Roads (2006);
- Law on National Water Program (2006);
- Law on Land Use Control and Protection (2008);
- Decision N1325-Ն of the Republic of Armenia of November 19, 2014 "On defining the procedure for implementation of public notice and consultations";
- Decision N 71-Ն of the Government of the Republic of Armenia of January 29, 2010 "On approving the Red Book of Animals of the Republic of Armenia";
- Decision N 72-Ն of the Government of the Republic of Armenia of January 29, 2010 "On approving the Red Book of Plants of the Republic of Armenia";
- Decision No. 781 of the Government of the Republic of Armenia of July 31, 2014 "On defining the procedure for their use for the protection of flora objects of the Republic of Armenia and their reproduction in natural conditions";
- Decision N 967-Ն of the Government of the Republic of Armenia of August 14, 2008;
- Order of the RA Minister of Health on approving the sanitary rules and norms of "Sanitary living rooms of employees in organizations" N 2.2.8-003-12;



- Decision No. 438 of the Government of the Republic of Armenia of April 20, 2002 "On Approving the Procedure for State Registration, Study, Preservation, Strengthening, Repair, Restoration and Use of Immovable Historical and Cultural Monuments".

In order to meet the relevant regulations and obtain a positive expert opinion, this preliminary application must be prepared in accordance with the law on environmental impact assessment and expertise (2014), and the relevant legal provisions relating to environmental protection must be observed.

In order to reduce the differences between the legislation of the Republic of Armenia and international environmental policies, the new law on environmental impact assessment and expert research was approved in 2014, in July. The new law establishes a procedure for the evaluation of environmental. The law requires that programs be evaluated in two stages: the initial stage, which includes verification and classification into groups "A", " B " or " C "depending on the type of action, and the main research stage, during which programs of category" A " and " B " are additionally studied. The law provides a list of actions proposed for programs subject to environmental impact assessment (by category), as well as a General description of the EIA report, which includes parts related to the program's impact on the physical, biological and social environment, as well as analysis of collective impacts. The EIA law sets out procedures and requirements for notification, documentation, public hearings, and court appeals.

Some provisions of other environmental laws were also taken into account during the assessment. These relate to air protection, cultural and historical monuments, flora and fauna, water use, seismic protection, waste, hygiene and protection of workers, such as:

Law “On Specially Protected Natural Areas” (2006)

The law “On Environmental Impact Assessment and Expertise” (law on EIA), which was adopted in 2014, provides a legal ground for introduction and implementation of state expertise in the scope of envisaged activity and concept. It also introduces the standard steps of the EIA process in Armenia for various projects and activities. In Article 14 it defines the general legal, economic and organizational principles for mandatory EIA implementation of various projects and concept documents, according to which the concept documents related to socio-economy, energy, urban construction, transportation, communication, agriculture, mining industry, industry, healthcare, environment, recreation, service, forestry, waste management, and water economy, areas are subject to strategic assessment and expertise. In addition, Section 4 of the same article, defines draft documents for different types of suggested activities. As prescribed by the law, the activities suggested by the fields subject to assessment and environmental expertise, are marked by one of the three (A, B, C) categories, according to the environmental impact mitigation. The suggested activities are separated according to the fields (energy, mining industry, chemical production, pharmaceutical industry, metal production and recycling, waste management, construction material production, light industry, infrastructures, water, urban construction, and agriculture, etc.). In the field of infrastructures, the above mentioned are classified under category A – construction and reconstruction of a road with four and more lines, or if the section continues uninterrupted for 10 and more kilometers – widening of roads with up to two zones to line with more zones. In the field of



infrastructures, B category relates to tunnels, underground or railway construction with 1km and longer lines, as well as building bridges on rivers with the capacity of 25 and tons and more.

It is worth mentioning that environmental expertise is necessary for all the activities not stated in Section 3 of this article, which are carried out in specially protected natural and forest areas, historical-cultural monuments, and green spaces allocated for public use.

According to the law, urgent activities undertaken for state security and for the purpose of mitigating consequences of emergency situations are not subject to environmental expertise.

The law on EIA mostly fits with the approaches which are followed by international conventions and development aid agencies (such as WB, USAID, EU, and MCC). The law is applicable for road construction, reconstruction and (or) activities related to their expansion, and a positive conclusion should be received from the Ministry of Environment State Environmental Expertise SNCO regarding environmental impact assessment prior to the launch of civil works. The law on EIA also envisages involvement and participation of the society in all the phases of EIA.

The works of the environmental impact assessment project and the Kajaran-Agarak section of the North-South road corridor investment project in Armenia, are subject to EIA as projects of A category. Based on the project of the environmental impact assessment expertise, which should be submitted to the Ministry of Environment, assignments will be developed in accordance with the law on EIA and a classification of the proposed project will be provided.

Land Code (2001)

The Land Code defines the main directives for management use of the state lands, included those allocated for various purposes, such as agriculture, urban construction, industry and mining, energy production, transmission and communication lines, transport and other purposes. The Code defines the lands under the specially protected areas as well as forested, watered and reserved lands. It also establishes the measures aimed to the land's protection, as well as the rights of state bodies, local authorities and citizens towards the land.

Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998)

The Law provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for - amongst other things - the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments. It is not, however, involved with the fate of modern monuments erected along the highway by private citizens in commemoration of accident victims. The relocation of those monuments will be coordinated by the respective provincial authority.



Law on Wastes (2004)

The law regulates legal and economic relations connected to the collection, transfer, maintenance, development, reduction of volumes, prevention of negative impact on human health and environment. The law defines objects of waste usage, the main principles and directions of state policy, the principles of state standardization, inventory, and introduction of statistical data, the implementation of their requirements and mechanisms, the principles of wastes processing, the requirements for presenting wastes for the state monitoring, activities to decrease the amount of the wastes, including nature utilization payments, as well as the compensation for the damages caused to the human health and environment by the legal entities and individuals, using the wastes, as well as requirements for state monitoring and legal violations. The law defines the rights and obligations of the state governmental and local governmental bodies, as legal entities and individuals.

Law on Environmental Oversight (2005)

The Law regulates the issues of organization and enforcement of oversight over the implementation of environmental legislation of the Republic of Armenia, and defines the legal and economic bases underlying the specifics of oversight, the relevant procedures, conditions and relations, as well as environmental oversight in the Republic of Armenia. The existing legal framework governing the use of natural resources and environmental protection includes a large variety of legal documents. Governmental resolutions are the main legal instruments for implementing the environmental laws. Environmental field is also regulated by presidential orders, Prime-Minister's resolutions and ministerial decrees.

Law on Specially Protected Natural Areas (2006)

The objective of this Law is to set forth the legal principles of state policy for the sustainable development, restoration, conservation and use of ecosystems, nature complexes and separate objects of specially protected natural areas of environmental, economic, social, scientific, historical-cultural, aesthetic, health, climate regulating, recreational or spiritual value. Nowadays, quantity of protected areas in RA is 23.

Law on Automobile Roads (2006)

The Law regulates economic, legal and organizational bases for development and administration of a motor road network; designing, construction, repair and maintenance, classification and registration of roads in the Republic of Armenia, as well as regulates legal relationships between bodies and organizations implementing those functions.

The Law on preservation and utilization of Immovable Monuments of History and Culture and of the Historic Environment (adopted November 11, 1989)¹.

¹ <http://www.parliament.am/legislation.php?sel=show&ID=1641&lang=arm>



Under the law the Project will have to comply with the provisions of the following chapters:

- (i) Chapter 19. Any construction activity in areas containing historical monuments or archaeological sites must be realized in agreement with the authorized body (Ministry of Education, Science, Culture and Sport).
- (ii) Chapter 20. Newly discovered sites obtain immediately protected status by law until they are included in the State Lists.
- (iii) Chapters 21-22. Destruction of historical monuments and its environment is forbidden. Before the realization of any kind of activity at the area of the site the authorized body must study it and give corresponding permits or solutions.

2.3 INTERNATIONAL AGREEMENTS

The Republic of Armenia has signed and ratified a number of international conventions and protocols, being the first to sign the Ramsar Convention in 1993 - on the preservation of wet territories. Of Particular significance for this program is the fact that the RA has replaced the Red books of plants and animals developed according to the definitions of the former USSR. This EIA report is based on the IUCN Red Books. In Table 1 are presented the international, regional, environmental, cultural and international conventions and agreements that have been signed and / or ratified by the Republic of Armenia.

Table 1: International multilateral environmental agreements signed and ratified by the Republic of Armenia.

N	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
1	Convention on Wetlands of International Significance especially as Waterfowl Habitat (Ramsar, 1971)	1975	1993	Ratified by USSR	
2	Convention on Biological Diversity (Rio-De-Janeiro, 1992)	1993	1992	1993	Re-registered in UN 1993
3	Cartagena Protocol on Biological Safety (Cartagena, 2000)		2000	2004	
4	UN Framework Convention on Climate Change (New York, 1992)	1994	1992	1993	Re-registered in UN 1993
5	Kyoto Protocol (Kyoto, 1997)			2002	Re-registered in UN 2003
6	Convention on Long-range Transboundary Air Pollution (Geneva, 1979)	1983		1996	Re-registered in UN 1997



N	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
7	Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)	1997		1996	Re-registered in UN 1997
	Protocol on Strategic Environmental Assessment (Kiev, 2003)		2003		
8	Convention on the Transboundary Effects of Industrial Accidents (Helsinki, 1992)	2000		1996	Re-registered in UN 1997
	Protocol on Civil Liability and Compensation for Damage caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters (Kiev, 2003)		2003		
9	UN Convention to Combat Desertification (Paris, 1994)	1996	1994	1997	Re-registered in UN 1997
10	Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989)	1992		1999	Re-registered in UN 1999
11	Convention for the protection of Ozone Layer (Vienna, 1985)	1988		1999	Re-registered in UN 1999
	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal, 1987)	1989		1999	Re-registered in UN 1999
12	Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998)	2001	1998	2001	
13	Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)		1998	2003	



N	Convention or Protocol, Name and Place	In Force	Signed	Ratified	Comment
14	Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)	1996	1999		
	Protocol on Water and Health (London, 1999)		1999		
15	Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001)		2001	2003	
16	Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (Geneva, 1976)	1978		2001	Re-registered in UN 2002
17	European Convention on Landscape (Florence, 2000)			2004	
18	Convention on Protection of the World Cultural and Natural Heritage (Paris 1972)			1993	
19	Energy Charter Treaty (Lisbon, 1994)			1997	
	Energy Charter Protocol on Energy efficiency and Related Environmental Aspects (Lisbon, 1994)			1997	
20	European Convention on Protection of Wild Nature and Habitat (Bern, 1979)	1982	2006		

2.4 SCREENING AND CLASSIFICATION

Tranche 4, 45km Kajaran-Agarak road section, under the North-South Road Corridor Investment Project has been screened with the ADB’s Rapid Environmental Assessment Checklist (REA). The classification was based on the most environmentally sensitive component of the project, which means that if one part of a project has the potential for significant adverse environmental impacts, then the project is to be classified as environmental category “A” regardless of the potential environmental impacts of other aspects of the project. Based on the REA Checklist, the project is classified as a Category “A”. According to the Armenian legislation a proposed project is classified as a Category “A” and an EIA report according to Armenian legislation is needed. As already



mentioned, this project is funded by the EDB, and the preparation of the EIA report was based on the requirements of the ADB SPD (2009) policy and Armenian legislation.

2.5 ADMINISTRATIVE FRAMEWORK

Governing Council

A Governing Council of the North-South Road Corridor Investment Program is chaired by the Prime Minister. It is comprised of two representatives from the Ministry of Economic Development and Investment, two representatives from Ministry of Territorial Administration and Infrastructure and one representative of each of the following entities: Ministry of Justice, Ministry of Finance and Economy and the Real Estate Cadastre Agency. The Governing Council key functions include guiding the overall policy and strategic direction of the MFF program, reviewing and evaluating its performance, and coordinating with other external aid agencies. The Governing Council holds a regular meeting at least once each month.

Executing Agency

The Executing Agency (EA) is the Ministry of Territorial Administration and Infrastructure (MTAI). MTAI is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the transport and communication sectors. The EA will oversee the implementation of the Program and the disbursement of the loan.

Implementing Agency

The MTAI set up a Road Department SNCO to manage day-to-day coordination, implementation, monitoring and administration activities of the project. RD includes Environmental Impact Management and Social Impact Management Services where environmental and social specialists are responsible for the management all environmental and social aspects of the North-South Road Corridor Investment Program and compliance of them to RA legalization and safeguard policies of donor organizations such as ADB's Safeguard Policy.

Design Engineer

Key responsibilities include:

- (i) Prepare the draft Environmental Impact Assessment (EIA), along with the relevant Environment Management and Monitoring Plan (EMP), and other documents as required;
- (ii) prepare the final Environmental Impact Assessment (EIA), along with the relevant Environment Management and Monitoring Plan (EMP), and other documents as required;
- (iii) submit the draft and final EIA, EMP for the Executing Agency (MTAI), Implementing Agency (RD) and EDB's review and approval;
- (iv) apply for and get a positive environmental expertise conclusion if needed from the Environmental Impact Expertise Center" SNCO of the RA Ministry of Environment for the EIA



report and EMP as prescribed by the Armenian legislation (including agreement with the RA Ministry of Education, Science, Culture and Sport regarding Project right of way).

- (v) develop Technical Specifications based on mitigation measures defined in the EMP and incorporate environmental clauses into Particular conditions of the tender and contract documents.

Supervising Engineer

During construction the key tasks of the Supervising Engineer will include the following major key activities:

- (i) supervise and monitor the construction of the Project including the implementation of the Site Specific EMP;
- (ii) ensure that all work associated with the Project are carried out in full compliance with the designs and specifications and following international engineering and quality standards;
- (iii) manage contract changes, contractor claims and scope revisions;
- (iv) monitor the Project performance, benefits and ensure compliance with all social requirements; ensure that environmental, health and safety requirements, road safety and monitoring are carried out in compliance with the relevant safeguards documents, the ADB safeguards policy and the applicable laws of Armenia;
- (v) liaise with government and municipal authorities, program management Consultants, NGO's, civil society, and other stakeholders concerned with the Project implementation to carry out proper consultation;
- (vi) ensure that the construction contractor prepares the detailed site specific EMP;
- (vii) handle the complaints based on GRM;
- (viii) carry out 2 visits during the defect's liability period;
- (ix) report to RD.

Contractors

The Contractors' key responsibilities are listed below but are not limited to the following:

- (i) prepare Site-specific environmental management plans (SEMP) and obtain the Engineer approval as a working construction document based on the present EIA report and the EMP, update the SEMP during the construction when needed and obtain the Engineer approval of the updated part;
- (ii) hire the services of one Environment Specialist and one Health & Safety specialist as defined in the tender document; hire the services of Archaeological Specialist;
- (iii) implement the SEMP as a special part of the contract and particular conditions; coordinate with the Engineer for the implementation of the various components of the EMP including monitoring;
- (iv) in cases of emergencies and accidents or extraordinary situations notify the Engineer and the relevant emergency authorities immediately;



- (v) obtain permits and approvals from relevant agencies and provide copies to Engineer;
- (vi) report on EMP implementation.

Eurasian Development Bank

EDB may carry out periodic project reviews, inspections of the Project throughout the Project cycle in conformity with the principles and requirements embodied in the SPD 2009 of ADB. EDB will provide assistance to the RD in managing the social and environmental impacts and risks, thus contributing to the promotion of the long-term sustainability of investments. To achieve this EDB will ensure that RD comply and adhere to the social and environmental safeguard requirements during project preparation and implementation.

EDB will also promote the disclosure of information about the Project through the placing the English version of the EIA report and EMP on the website.

Listed below are roles that EDB will perform through the different phases of the Project:

Pre-Construction:

- (i) Review project screening results and approves project categorization;
- (ii) Review and approves IEEs/EIAs on no-objection basis;
- (iii) Disclose IEEs/EIAs to the public through the EDB website;

Construction Phase:

- (iv) Review bi-annual reports and provides necessary advice to the RD;
- (v) Undertake two environmental review missions per annum for environment category “A” and one mission for category “B” projects.

Post-construction Phase:

- (vi) Undertake and review post construction audit.

The government agencies and their roles that could be involved in the Tranche 4 -45km Kajaran–Agarak Road Section Project are as follows:

Ministry of Environment

The Ministry of Environment (ME) is responsible for the protection, sustainable use, and regeneration of natural resources as well as the improvement of the environment in the Republic of Armenia. In those areas, the ME’s authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement.

The ME implements those functions through its structural departments. “Environmental Impact Expertise Center” (EIEC) is one of the key departments of ME that is responsible for reviewing and issuance of EIA



reports and adding conditions when necessary to protect the environment. In order to comply with the relevant regulations, the EIA should be prepared in accordance with the RA Law on Environmental Impact Assessment and Expertise (July 22, 2014) in order to obtain a positive assessment conclusion from the ME. Legislative provisions on environmental protection should be taken into account accordingly.

The Article 14 of the new law on "Environmental Impact Assessment and Expertise " (2014) for "A" category projects that include "construction or reconstruction of new roads with four and more lanes or upgrading of roads with maximum two lanes to four lanes" an EIA should be submitted to ME for the expertise.

The ME is also the Government authorized body in the area of waste management of the RA. Article 8 of the Law on Waste (24.11.2004) sets authorities of the environmental sector. The Ministry of Environment of RA as the state authorized body in the area of waste management is mandated with the following tasks and responsibilities in environmental protection area:

- (i) Develop the state policy for the sector and ensure its implementation;
- (ii) Coordinate activities of the state authorized bodies in the area of waste management;
- (iii) Ensure system of economic incentives for implementation of less-wasteful technologies, waste collection and recycling;
- (iv) Approve waste disposal quotas for legal entities and private entrepreneurs;
- (v) Approve sites for location of waste management objects;
- (vi) Provide a waste inventory, generation, removal (elimination, disinfection, disposal) and recycling procedure;
- (vii) Provide a procedure on licensing of activities in the area of dangerous waste reprocessing, disinfection, storage, transportation and disposal, as well as carry out licensing of those activities;
- (viii) Provide lists of dangerous and restricted waste;
- (ix) Provide a procedure on trans-boundary transportation and removal of waste;
- (x) Ensure establishment of structures for placement of disinfected and non-recyclable waste;
- (xi) Carry out international cooperation in the area of waste management; and
- (xii) Carry out other authorities provided by law.

Ministry of Territorial Administration and Infrastructure

The Ministry of Territorial Administration and Infrastructure of the Republic of Armenia is a central body of executive authority that develops and implements the policy of the Government of the Republic of Armenia in the field of territorial administration and infrastructure management. Ministry ensures the implementation of programs of socio-economic development of the Republic of Armenia by the local government authorities of the Republic of Armenia.



Marzpetarans (regional administration bodies) are responsible for administration of public infrastructure falling under the regional jurisdiction. Bodies of local self-government (communities) are responsible for administration of public infrastructure of local significance registered as ownership of communities.

After structural changes within the RA Government the former Ministry of Energy and Natural Resources was merged with the Ministry of Territorial Administration and Infrastructure, so the responsibility of the elaboration and implementation of the policies of the Republic of Armenia Government in the energy sector now also carried out by the Ministry of Territorial Administration and Infrastructure. The ministry is also responsible for the protection, sustainable use, and regeneration of natural resources, and implements its functions through the its relevant agencies.

The “Road Departement” SNCO is the main structure of the Ministry ensuring the effective implementation of transport sector programs in the Republic of Armenia, including the capital and development programs of the transport sector approved by the Government of the Republic of Armenia and developed by the Ministry of Territorial Administration and Infrastructure, also it ensure the programs developed at the expense of funds provided to the Republic of Armenia by states and international lending organizations, including the implementation of the works envisaged by the North-South Road Corridor Investment Program.

Environmental protection and Mining Inspection Body

Environmental protection and Mining Inspection Body was created based on the RA Law on “Inspection bodies”, in the result of restructuring of Environmental Inspectorate of the Ministry of Environment and Environmental and Mining Inspectorate of RA. The Environmental Protection and Mining Inspection Body of the Republic of Armenia (hereinafter referred to as the Inspection Body) is a state body subordinated to the Government, performing inspection, supervision and other functions defined by law, which applies sanctions in the field of environmental protection and mining industry, acting on behalf of the Republic of Armenia.

Ministry of Education, Science, Culture and Sport

The Ministry of Education, Science, Culture and Sport (MESCS) of the Republic of Armenia is a central body of executive authority that elaborates and implements the policy of the Government of the Republic of Armenia in the spheres of education, science, culture and sport. The MESCS has jurisdiction over archaeological, historical, and cultural sites. Department for protection of historical and cultural monuments under the MESCS is responsible for conservation of monuments which are archaeological/cultural values, as well as obliged for fully protection of historical – cultural immovable groups of monuments, complexes of monuments, natural and historical environments, historical-cultural lands and surrounding landscapes which are considered to be state properties.

Ministry of Health

State Hygienic and Anti-epidemiological Inspection Unit of the Ministry of Health of RA is responsible for the following actions implementation:



- Coordination of all issues related to health (including those on noise and vibration);
- Supervise implementation of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens.

State Committee of the Real Estate Cadastre

The State Committee of the Real Estate Cadastre adjunct to the RA Government is a republican body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the area of maintaining the unified national cadastre of immovable property.

3. PROJECT DESCRIPTION

3.1 INTRODUCTION

This Environment Impact Assessment report is prepared for the Kajaran-Agarak road section in Armenia under the North-South Road Corridor Investment Program, Tranche 4. Prior to initiating an environmental and social impact assessment, a feasibility study was undertaken and Rapid Environmental Assessment (REA) Checklist was filled to reveal environmental and social issues to be taken into consideration while preparing the designs and analysing potential environmental and social impacts.

Preparation of Draft Environment Impact Assessment (Including Draft Environment Management Plan) based on the preliminary design in accordance with ADB Safeguard Policy Statement (June 2009), other relevant ADB and EDB manuals/guidelines as well as relevant legislation and guidelines of the Republic of Armenia.

The environmental and social baseline conditions of the project area were documented by means of review of project related documents, including information provided by the design team, as well as discussions, visits, literature reviews and data research. The project team includes environmental and social consultants to work with the design team, collect and review environmental and social data, undertake environmental and social scoping process, conduct environmental and social analysis, develop Environmental Impact Assessment with basing on Environmental Management Plan.

This Environment Impact Assessment report describing proposed project activities, baseline environmental conditions, potential impacts and mitigation measures of Kajaran-Agarak road section in Armenia is prepared by J/V IRD ENGINEERING S.R.L. and GP Ingegneria S.R.L companies.

3.2 LOCATION OF THE PROGRAM

In Tranche 4, the section Kajaran-Agarak (section of M2 road from km 328+600 to km 384+000) is the most South one going from Kajaran to the Iranian Border.



The project consists of two Lots (Lot 1 and Lot 2) for a total length of about 45 km:

- **Lot 1** includes about 21 km (5km+16km) road from Agarak to Vardanidzor (Section IV.3) and about 11 km road from Vardanidzor to tunnel exit (Section IV.2.C).
- **Lot 2** includes about 7 km road from tunnel entrance to Kajaran (Section IV.2.A) and about 6 km of the tunnel and access roads (Section IV.2.B).

The Kajaran-Agarak road section is mainly located in the gorge, as shown below (Figure 3).



Figure 2: Subdivision of Kajaran-Agarak road section



Figure 3: The road alignment



Detailed maps of the proposed project, with all the planned infrastructure, are presented in Annex 3.

3.3 DESCRIPTION OF ACTIVITIES

The proposed project covers preparation of Detailed Design for Kajaran - Agarak section of M2 road from km 328+600 to km 384+000.

This existing road is the most southern part of North-South road corridor and located in mountain terrain with steep slopes (12-20°).

The total length of the project is approximately 45 km road:

- about 21 km road from Agarak to Vardanidzor
- about 11 km road from Vardanidzor to tunnel exit (Lot 1)
- about 7 km road from tunnel entrance to Kajaran
- about 6 km of the tunnel and access roads (Lot 2).

The road is foreseen with asphalt-concrete pavement (as per proposed design), with design speed 100km/h, which consists of upgrading and widening existing 2-lane road (km379+000 – km384+000, about 5km) and construction of completely new 2 lane single carriageway with bridges and tunnels.

Besides, the works include design of connections (or interchanges) of new road with existing M2 road, communities and businesses if necessary.

This section of 45km will be the continuation of Sisian - Kajaran 60 km road section.

The construction works will be carried out on a 32 km road section, about 21 km from Agarak to Vardanidzor (5 km widening of the existing road + 16 km new road), about 11 km from the tunnel exit from Vardanidzor.

The works also include the survey and investigations of all existing infrastructures which are faced with new designed road.

Considering the traffic, the Kajaran-Agarak road junction can be classified as a category II road. However, the North-South Corridor is also part of the Asian Highway Network (AH 82), where the intensity of traffic will increase in the near future.

The new road section alignment will be designed and constructed to standards that will result in improved road markings, signage, tunnels, bridges, drainage, culverts, overpasses, underpasses, and shoulders.

As per design there will be a total of:

- 14 bridges:
 - PK1340+00 - PK 135+00 – 100m
 - PK 137+40 - PK 138+40 – 100m



- PK 150+40 - PK 151+40 – 100m
 - PK 150+20 - PK 157+80 – 160m
 - PK 159+80 - PK 160+40 – 60m
 - PK 166+00 - PK 168+80 – 240m
 - PK 170+20 - PK 170+60 – 40m
 - PK 173+20 - PK 174+80 – 60m
 - PK 176+60 - PK 177+40 – 80m
 - PK 187+80 - PK 188+40 – 60m
 - PK 199+20 - PK 200+40 – 120m
 - PK 204+00 - PK 205+00 – 100m
 - PK 250+20 - PK 251+60 – 140m
 - PK 351+40 - PK 353+80 – 240m
- 3 tunnels:
 - 1 (from km 3+700 to km 10+600, 6975m);
 - 2 (from km 16+300 to km 16+700, 400m);
 - 3 (from km 34+900 to km 35+300, 420m).
 - 27 culverts:
 - 1 (km 1+000); 2 (km 13+200); 3 (km 13+600); 4 (km 13+900); 5 (km 14+600); 6 (km 14+900); 7 (km 15+300); 8 (km 15+600); 9 (km 15+900); 10 (km 16+200); 11 (km 17+200); 12 (km 17+900); 13 (km 18+500); 14 (km 18+600); 15 (km 18+800); 16 (km 19+000); 17 (km 19+300); 18 (km 19+500); 19 (km 20+500); 20 (km 21+800); 21 (km 22+200); 22 (km 23+200); 23 (km 32+400); 24 (km 32+800); 25 (km 33+600); 26 (km 33+800); 27 (km 34+100).

The principal quantities of the works to be implemented as per draft design include:

Excavation: 6000000 cubic meters,

Embankment: 1200000 cubic meters,

Hot asphalt pavement: 340560sq. meters

Due to rocky terrain, grassing of the embankments is not envisaged

A typical road cross-section with 2 lanes and 3 lanes (tunnel entrance/exit and final part of the project) is shown in Figure 4, 5 and 6 below.



Typical Cross Section 2 Lanes - Տիպային լայնակի կտրվածք 2 երթուղեկի շերտ
Քկ/Պկ 0+000 - Քկ/Պկ 1+450

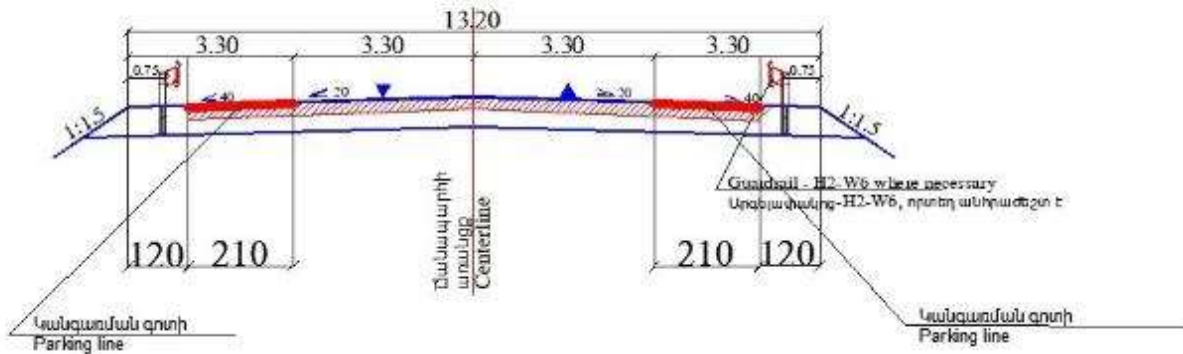


Figure 4: Typical Cross Section for 2 Lanes

Typical Cross Section 3 Lanes - Տիպային լայնակի կտրվածք 3 երթուղեկի շերտ
Tunnel Exit/Entry / Թունելի ելք/մուտք - Քկ 37+750/Պկ 37+750

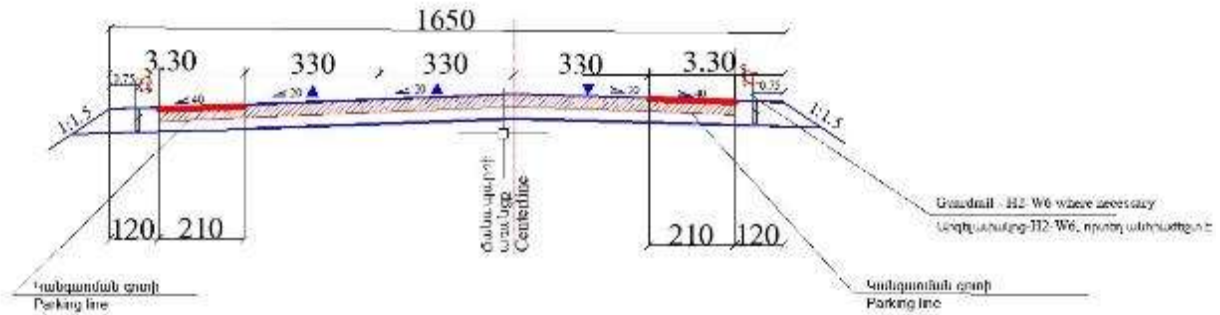


Figure 5: Typical Cross Section for 3 Lanes, tunnel exit/entrance

Typical Cross Section 3 Lanes - Տիպային լայնակի կտրվածք 3 երթուղեկի շերտ
Քկ 37+750/Պկ 37+750 - End of the project / ԾՎ

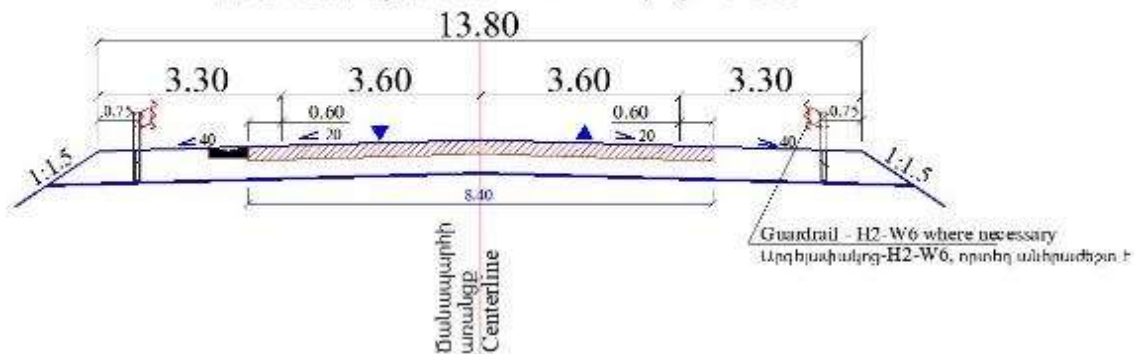


Figure 6: Typical Cross Section for 3 Lanes, end of the project

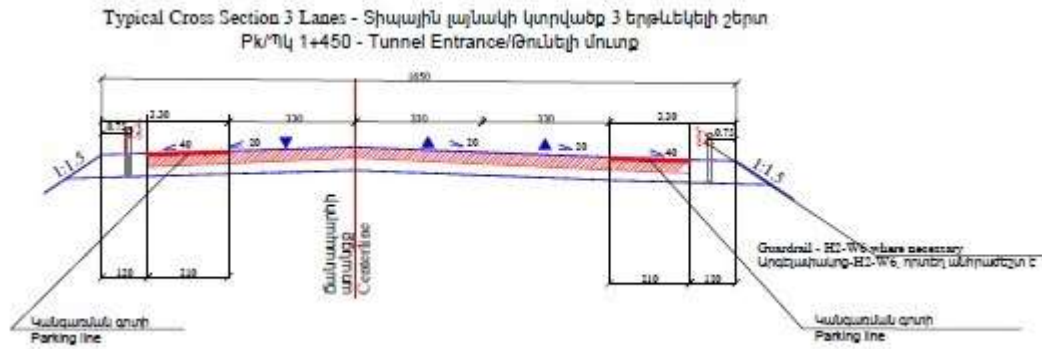


Figure 7: Typical Cross Section, PK 1+450, Entrance of the tunnel

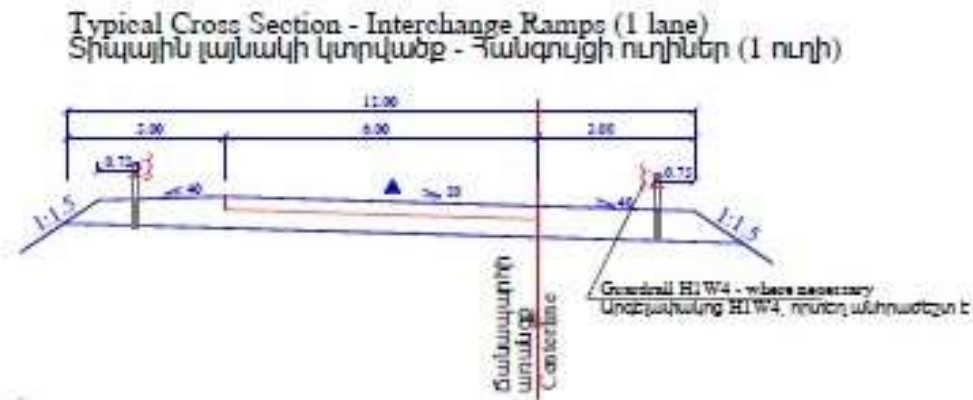


Figure 8: Typical Cross Section, node paths

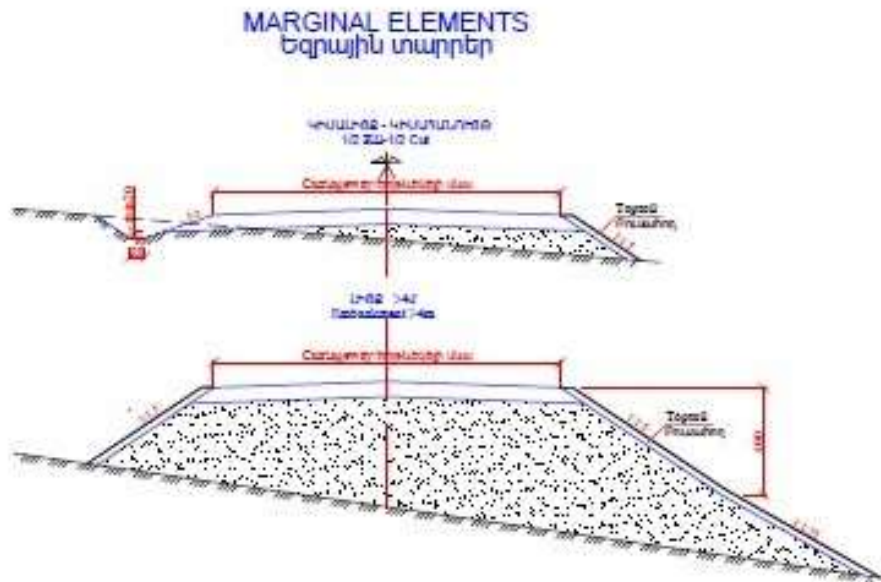


Figure 9: Typical Cross Section, edge elements

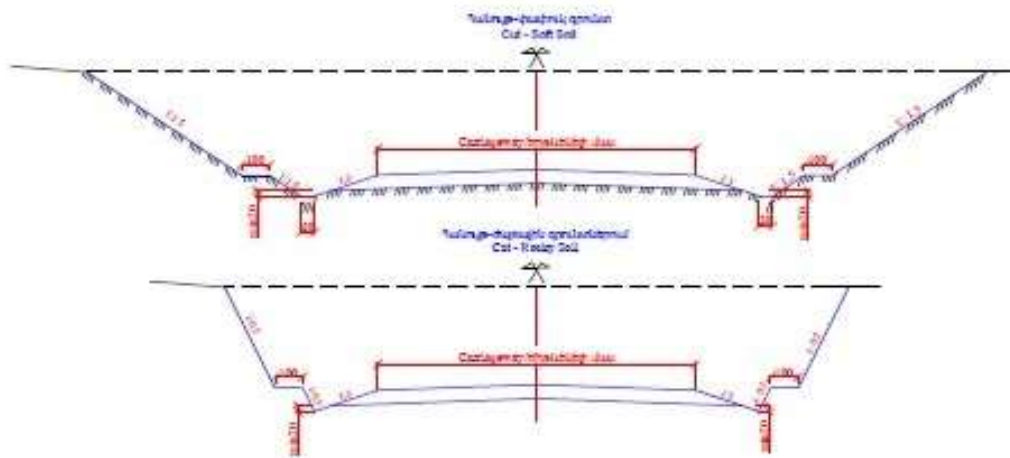


Figure 10: Typical Cross Section, extraction

The road draft design has been prepared in accordance with (i) Bridge Design Building Code SNIP 2.05.03.84, Construction Norm of Republic of Armenia IV11.05.02-99, AASHTO and Eurocodes. The structural elements of the project designed with consideration to the high risk of seismic activity and flooding.

Relocation of Utilities including:



- Drinking water pipelines
- Irrigation channels/pipelines
- Gas Pipelines
- Electricity power lines

It is expected that construction will be undertaken over a period of 5 years.



4. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

This section describes the relevant physical, environmental, socio-cultural, and economic conditions of the study area. It also represents existing and proposed development activities in the program space to be affected, including those territories that are not directly related to the program.

The area of planned works is located in the Syunik region of the Republic of Armenia. The region is characterized by a dissected, structural erosion-relief type: moderate steep, soft, partially rocky slopes, weak wavy watershed, with folding structures of intraocular and balloon rocks, with stair cataracts.

4.1 ENVIRONMENTAL CONDITIONS (PARAMETERS)

Climate

The climate of Syunik is influenced by the Eastern atmospheric masses from the Caspian Sea and the dry Iranian highlands. The climate has a continental characteristic. When wet air masses enter the territory of the Zangezur range, they change significantly and become dry. However, the extreme difference in topography leads to a wide variety of climates. Vertical zoning is obvious, and temperatures usually decrease in parallel with altitude, while the amount of rain increases: 1) At an altitude of 500-1000m, the duration of non-frosty days is 270-300 per year. Annual precipitation is 250-350mm, and the average annual relative humidity is 60%. 2) At an altitude of 1000-2300 m, the climate is semi-dry. The duration of non-frosty days is 120-160 days per year. Annual precipitation is 500-650 mm, and the average annual relative humidity is 50-60%. 3) The altitude is up to 2300 m. the average annual precipitation is 550-750 mm, and the relative humidity is 60-70 mm%. 4) 2300-2500 m altitude is characterized by a moderate cold climate. Annual precipitation is 55-750 mm, average relative humidity-70-80%. The duration of non-frosty days is 160-280 days per year. Average temperature in January is (-2) - (-4)°, in July- 16-18°. 5) The cold, humid mountain climate is typical for an altitude of 2300-3300 m. Precipitation is greater (700-800 mm (in some parts -900 mm) and 250-300 mm, respectively) than evaporation. Too much moisture causes surface flows, which in turn cause spatial and linear erosion. The average temperature in January is (-10)°C, and in July- 10-12 °C. Duration of non-frosty days is 50-80 days per year. Cold weather prevails. 6) At an altitude of 3200-3500 m, despite the intensity of solar radiation and prolonged sunlight, the balance of solar radiation is mostly negative throughout the year. The climate is harsh and cold with winters of six months or more. The amount of rain per year is about 800-900 mm. These are favourable conditions for the accumulation of moisture (in the form of snow or ice). The average depth of snow cover is two meters, and the number of snow-covered days in a year is 270. Snowfall persists throughout the year (in the form of snow, or ice) on uplift or peak sections. Short and cold summers do not provide sufficient temperature for vegetation growth.

Permanent snow cover starts from 1200 m above sea level and lasts for 35-165 days. Snow depths between 15 and 180 cm. It is kept at an altitude of up to 1500 m from 1-1. 5 months to 6.5-7 months at an altitude of 3000



or more. The snow cover is 15-20 cm at an altitude of 1300-1500 m, and at an altitude of 3000 m or more-120-180 cm (due to the wind, a 2-3 m thick snow cover is formed on concave surfaces in places).

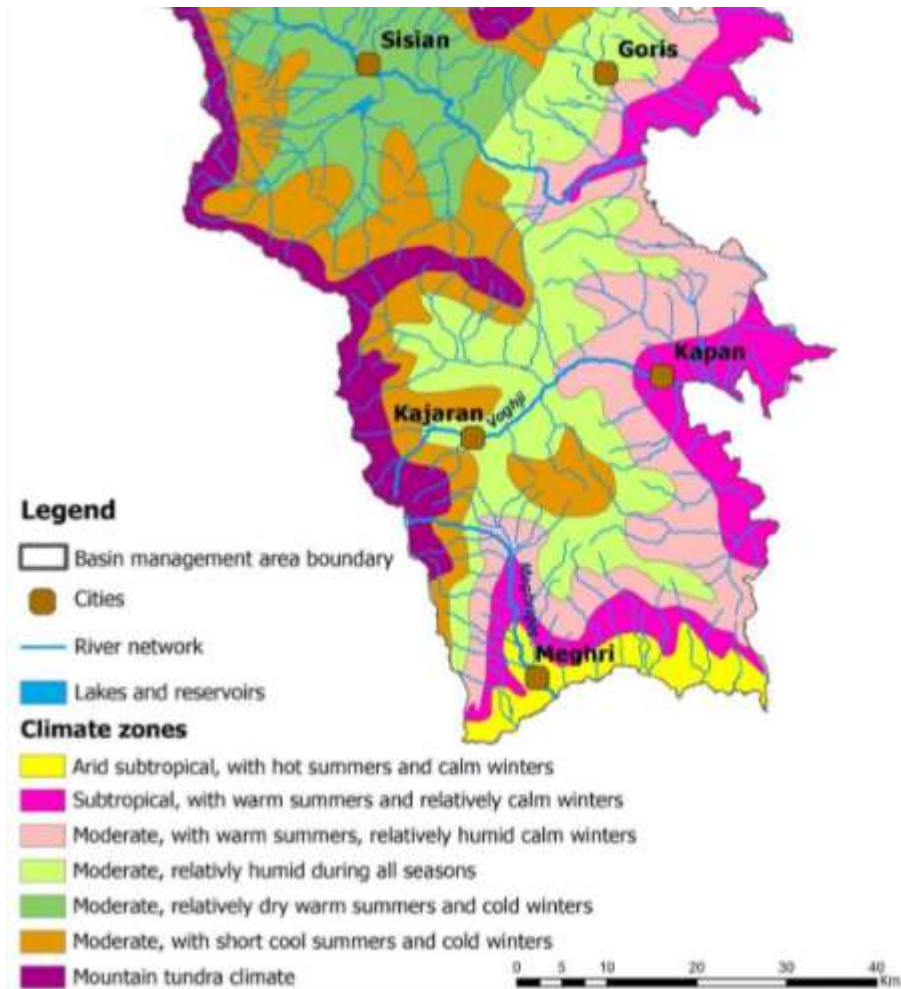


Figure 11: Climate zones of the program space



Table 2: Air temperature

Name of the locality or weather station	The height above the sea level. m	Average temperature by months °C												The annual average, °C	Minimum °C	Maximum °C
		January	February	March	April	May	June	July	August	September	October	November	December			
Meghri	627	1,5	3,5	8,2	14,1	18,8	23,2	26,3	25,9	21,5	15,3	9,3	4,0	14,3	-18	43
Kajaran	1843	-3.2	-3.0	0.3	6.1	10.0	14.2	17.0	16.7	13.5	8.2	3.2	-1.3	6.9	-22	34

Table 3: Air relative humidity

Air relative humidity, %		
months		Monthly average, at 15:00



Name of the locality or weather station	January	February	March	April	May	June	July	August	September	October	November	December	Annual average	The coldest month	The warmest month
Meghri	6 5	6 1	6 2	62	62	55	5 0	52	60	67	68	66	61	56	38
Kajaran	6 6	6 9	7 1	68	72	68	6 3	65	69	71	68	67	68	67	52



Table 4: Rainfall

Location	Rainfall, mm												year
	Average monthly / annual maximum												
	By months												
	January	February	March	April	May	June	July	August	September	October	November	December	
Kajaran	42	51	69	80	86	48	22	18	27	52	48	42	686
Meghri	18	18	32	41	52	30	10	7	13	23	24	15	283

(Source - «State hydrometeorology and monitoring service of Armenia» SNCO, RA ME)

Atmospheric air

The main sources of atmospheric air pollution at the road construction sites are the exploited mines and vehicles.

Atmospheric air quality (pollution) in the territory of the Republic of Armenia is controlled by the “State hydrometeorology and monitoring service of Armenia” SNCO of the Ministry of Environment of the Republic of Armenia, which, however, does not have monitoring observation points in the presented area.

As the main air pollutant in the area is dust, measurements of dust content in the air were performed at several points, the results of which are given in Annex 14.

Noise & Vibration

Existing traffic levels in the urban centres are a noise concern, even at night. The new road, acting as bypass should reduce traffic in the urban centres, therefore reducing noise in this location, however there will be an increase in noise from the construction and the large number of vehicles predicted to use the new road.

A study was conducted, during which basic data on noise vibrations were collected, the detailed information of which is presented in Annex 14.

Surface waters and groundwaters

The main water resources of the Kajaran-Agarak section of the North-South highway are supplied by the Meghri river, in the middle and lower courses. The highway has an impact on the few rivers in the territory of Meghri and the Araks rivers.

The **Voghji river** begins from the small lakes and sources of the slopes of mount Kaputjugh of the Zangezur mountain chain, on an elevation of 3650 m above sea level and it feeds into the Araks river on an elevation of



740 m above sea level. The total area of the watershed of the Voghji river is 643 km² in the territory of the Republic of Armenia. The total length of the river is 82 km and the total area of the watershed is 2337 km². The largest tributaries are Geghi, Norashenik, Geghanush, and Vachagan, etc. The relief of the Voghji river basin, particularly in its upper and lower courses, represents a network of medium and high mountains and deep gorges. Voghji is a typical mountain river. Voghji river has a large drop which reaches 60 meters per one km in the upper course of the river. The basin of the Voghji river is mostly covered by forests. Hydro Power Plants of Kapan and Jrakhor are operated with its waters. The waters are also used for irrigation purposes. The feeding is mixed and the freshet happens in the months of April-July. Mudflows are quite common during freshet. The towns of Kajaran, Kapan, and Kavsakan, as well as numerous other rural communities are situated on the banks of Voghji.

The hydrographic network of the watershed basin of river Voghji is quite developed - 2,4km/om², which is based on the high location of the area, rock-cut relief, climate factors, and forest areas, etc. The waters of river Voghji are of high quality until the borders of Zangezur Copper and Molybdenum Combine mine, which uses the greater part of the river water for industrial purposes. The town of Kajaran uses the river waters for economic-household needs and although the city has a sewerage system, it does not have an active cleaning station and the water flows practically go back to the river without being cleaned.





Figure 12: Formation of Voghji river upstream / photo is presented from "Kajaran Geoecological Atlas", Kajaran, ECG "Keni" NGO edition 2015, page 30 /

The **Meghri river** begins from the small lakes and sources located on the eastern slopes of the Zangezur mountain chain (3300 m above sea level) and it feeds into the Araks river, down to the town of Meghri (500 m above sea level). The length of the river is 36 km, and the total area of the watershed is 336,3 km². Ayrijur is the largest tributary. The river valley is V-shaped in the upper course and it gets wider in the lower course. It is mostly fed from rain and snow (68%), and the freshet happens in spring during which the 71% of the annual flow is generated. The average annual flow rate is 3,31 m³/s, and the maximum flow rate is 87,5 m³/s (South Water Basin Management Plan, Yerevan 2016), the 104,5 million m³ water are used for irrigation purposes. The river causes mudflows. The tributaries of the Meghri river, feeding into the Araks river are Karchevan, Karavget, Malev, Astghadzor, Shavigh, and Nrnadzor.

The ecological and quality norms of RA surface waters of the 14 major river basins in the territory of Armenia were defined by the decision of the RA government N 75-Ն, 27.01.2011. Five categories (classes) of surface water quality were defined: category I (excellent), category II (good), category III (medium), category IV (insufficient), and category V (bad).

According to those norms, the water quality in the upper courses of the rivers of Voghji is rated as category II ("good"), and the quality in lower courses is rated as category III ("medium"). The waters of the Voghji river become polluted down the flow. As they flow along the town of Kajaran they become "insufficient" (IV) or "bad" (V). The water quality of the Meghri river waters in the Meghri river basin is rated as category II ("good"), with an exception for the section of the river flowing from the villages of Tkhkut to Vardanidzor, where the water quality was rated as category V ("bad") during the months of summer and spring. The water quality of the basin of the Karchevan river is rated as category V ("bad").

Two small natural lakes are located in the upper section of the river Meghri, on an elevation of around 3200 meters. One of them is Tsakkar which takes up around 5 hectares of space.

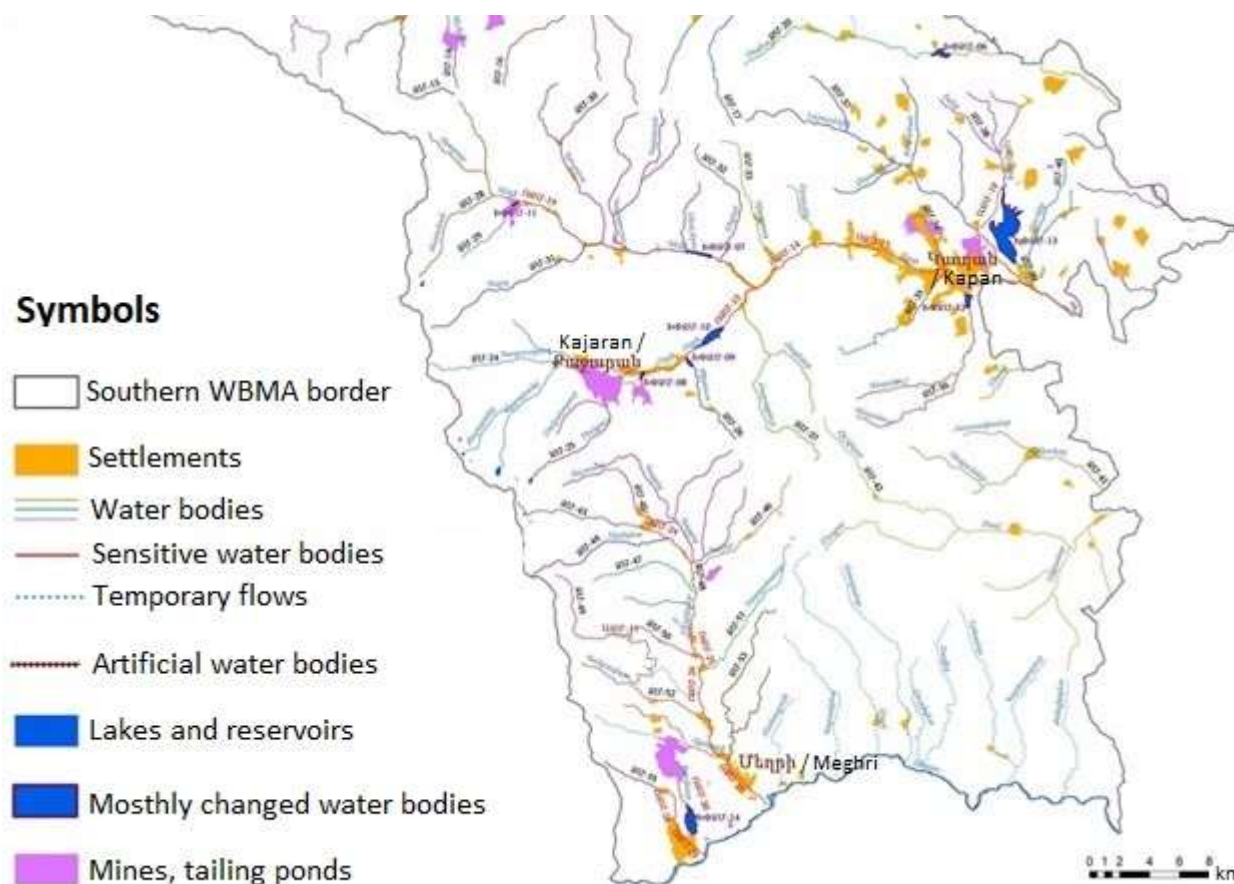


Figure 13: Voghji and Meghri river section of the southern water basin management areas with a depth of 8 meters. The total area of lake Kapuyt is 3 hectares and its depth is 6 meters. There are no major water reservoirs in that area.

Table 5: Hydrographic data of the Meghri river

River name	Average annual flow, m ³ /s	Annual flow, mil. m ³	Flow module, l/s km ²	Height of the flow layer, mm	Flow rate, average
Meghri	3,23	102	11,8	372	0,57

Table 6: Meghri river flow

River name	Average annual flow m ³ /s	Maximum flow, m ³ /s	Minimum flow, m ³ /s
Meghri	3,23	87,5	0,94

In the Table 7 the water temperature of the Meghri river within the borders of the town of Meghri is presented. It depends on the air temperature fluctuations and reaches the highest temperature in the



months of July-August. The lowest temperature is observed during the months of January-February. The river does not freeze during winter.

Table 7: Average monthly water temperature, °C

River section	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Meghri-Meghri	1.3	1.7	4.7	8.9	12.0	13.5	19.1	17.0	15.8	11.4	6.4	2.8

According to the hydrographical atlas of Armenia the turbidity rate of the river, based on the data obtained from the observation point of the town of Meghri, reaches 400 g/m³ and in Vardanidzor section - 250 g/m³.

The small tributaries of the Araks river, flowing from the town of Meghri to the east (Shemeglukh, Karavget, Malev, Astazurget, Shavzir, Suriget, Newvadi-Karisbajur, and Tondoyirget) are considered rivers of the Meghri river basin, most of which are drying out. Those are small tributaries with low water flow. These tributaries occupy around 25.4 mil.m³ space. The villages of Alvank, Shvanidzor and Nrnadzor are located in their valleys. Water pumped from the Araks river is mostly used for agriculture purposes in those villages.

Karchevan is a small river located to the west from the town of Meghri. Agarak’s copper-molybdenum mine, the large ore processing plant, as well as the town of Agarak itself and the broad agricultural activities happening in the lower parts of the town greatly affect this river. The Bughakar tributary feeds into the Karchevan river.

Natural and man-made impact on the rivers of Voghji and Meghri

1. Natural impact

The main natural impact is the climate change, as a result of which a rise in the average air temperature, a decrease in the annual precipitation, natural changes in relative air humidity, river natural flow, as well as changes of river water quality acidity and mineralization regimes are anticipated. In the long-term, the climate change in the Meghri river basin may have a significant impact on the accessibility of natural water resources.

Years of drying and water scarcity have already been observed in the Meghri river basin, which resulted in the increase of the demand for water usage for irrigation purposes. At the same time, as a result of years of high floods, mudflows and flooding of areas have caused emergency situations.

2. Anthropogenic impacts

The types of man-made impact affecting the natural environment of the Voghji and Meghri river basins, including the quantity of water resources and their quality, are the following:

a/ water intake for dinking-household purposes makes up around 3-5% of the general water supply of the southern water basin management area and it is not considered a significant impact. However, we need to



keep in mind that potable water quality is prescribed with high requirements, and the quantity of waters corresponding to those requirements is limited.

b/ water intake for irrigation purposes has a significant impact on the water resources in the Meghri river.

c/ water intake for industrial purposes has a significant impact on the amount of water resources in the Voghji river basin.

d/ disposal of dirty household wastewater has a significant impact on the quality of water resources of the Voghji and Meghri rivers, in the sections from the town of Kajaran to the Voghji tailing dump, from the town of Meghri to the Araks river, and from the town of Agarak to the area near the river-bed.

e/ dewatering for food and other industrial purposes has a significant impact on the Voghji and Meghri rivers.

f/ dewatering for mining purposes has a significant impact on the quality of the water resources of the Voghji and Meghri rivers. The failures of the centralized dewatering systems of the wastewater accumulated as a result of mining industrial activities cause leakages. As a result, wastewater penetrates into the rivers polluting the following sections of the rivers: Voghji river section from Zangezour Copper-Molybdenum Combine to the RA border, the Karchevan river from Agarak Copper-Molybdenum Combine to the Araks river, and the Meghri river section from Tkhkut to the village of Vardanidzor.

g/ the mines have a significant impact on the water quality of the Voghji and Meghri rivers. The surface water flows that have accumulated as a result of spring and winter floods, snowmelt and heavy rains, which are saturated with high concentration of heavy metal, are polluting the following sections of the rivers: the Voghji river section from the town of Kajaran to the Voghji recultivated tailing dump and the Meghri river section adjacent to the community area of Tkhkut, the Karchevan river section from Agarak's Copper-Molybdenum Combine mine to the Araks river, and the Meghri river section from Tkhkut to the village of Vardanidzor.

h/ the hydro power plants, unable to sustain the ecological flow, impact the following sections of the Meghri river: from the Lichk community to the mixing of the Gozgoz tributary and from the Vardanidzor community to the town of Meghri. (There are no HPPs in the Kajaran section of the Voghji river.)

i/ fish breeding does not impose a significant impact on the water quantity and quality of the Voghji and Meghri rivers.

j/ agriculture and use of fertilizers do not impose a significant impact on the Voghji and Meghri rivers. Overgrazing and the extent of emissions from animal husbandry do not have a significant impact on the water quality of the Voghji and Meghri rivers.



k/ deforestation, transporation, solid waste (except for mining industry waste) do not pose a significant impact on the water quality of the Voghji and Meghri rivers, although the water pollution with household solid waste in the river-beds in the surroundings of the communities is quite noticeable.

l/ tailing dumps and mining industry dumps have a significant impact on the water quality of the Voghji and Meghri rivers. During the periods of spring and summer floods, as a result of snowmelt and heavy rains a great extent of harmful substance falls into the rivers from mine dumps impacting the water quality in the following sections: Voghji river section from Zangezur Copper Molybdenum Combine waste dump to the mixing of the Geghi river, etc., the Agarak river section from Khachidzor (Darazam) waste dump to the mixing of the Meghri river. (Six active and four recultivated tailing dumps operate in the river-bed.)

Description of groundwaters

The groundwaters have local distribution in altitudinal zones, while aquifers are common in river-beds and inter-mountainous concavities. The following underground aquifers and dehydrated areas are distinguished:

- a) Water conduit aquifers of the modern (Q₄) alluvial-proluvial sediments of the Meghri river basin;
- b) exogenic fracture, aquifers dehydrated as a result of surface water flow infiltration in intrusive rock faces, fracture and cleft palate waters of tectonic infractions (P₂-N).

The sediments of the modern (Q₄) alluvial-proluvial sediment water conduit aquifer, filled with sand dune aggregate, boulder and breakstone formations, are common in the narrow (100-300 m) valley of the Meghri river. The level of the waters of this water conduit aquifer ranges within 0.1-10.0 m and is completely dependent on the level of the river water.

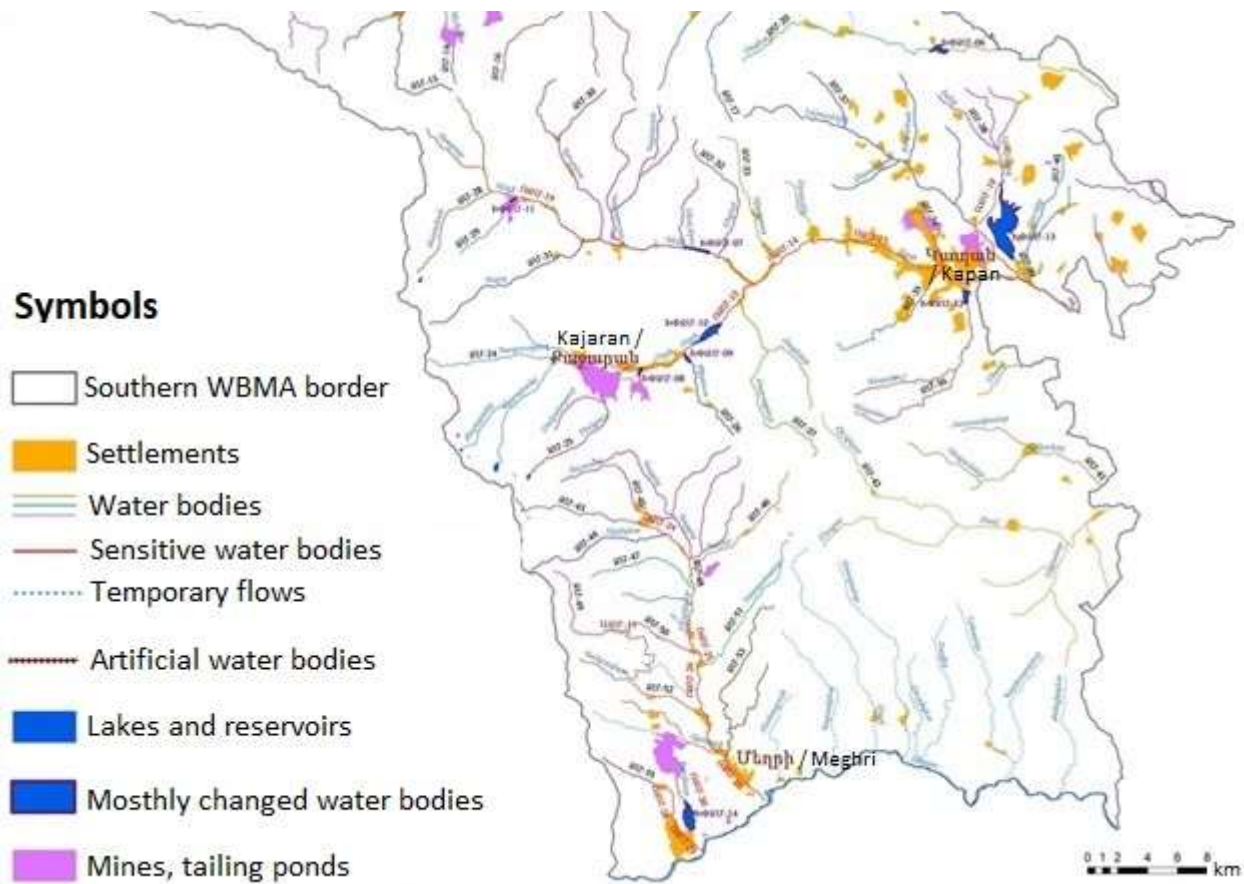


Figure 14: Map showing the allocation of surface water bodies in the southern water basin management territory, in the section of the Voghji and Meghri rivers.

Waters generated as a result of elluvial-deluvial formations are not widely distributed. They are fed by atmospheric precipitation and discharge is done through sources.

The fractures of rock faces which are filled with aeration materials, contribute to the accumulation of groundwaters in aeration fractures. Fracture and cleft palate waters are registered in underground mountain openings in the form of humidity, extreme humidity, rare dripping, and occasional dripping. The fact that the greater part of the area has a divided relief and a network of valleys, that all of the area is occupied by greatly steeped slopes which creates a natural drainage system, contributes to the scarcity of groundwaters limiting penetration of surface waters into deeper aquifers.

Fracture and cleft palate waters (N2-Q) of exogenic openings, dehydrated zones of the aeration layer, tectonic infractions, and mineral substances are adjacent to ground rock faces which are presented with porphyrites, granodiorite, and syenite rock faces.



The exploitative resources of the groundwaters of the Voghji and Meghri river basins have not been approved by the state or territorial committees of resources. According to the average yearly perennial significance, the natural resources of the groundwaters of the basin of the Voghji river comprise 185,1 mil. m³/year, the groundwaters of the basin of the Meghri river comprise 59,21 mil. m³/year.

Very small surface water conduit aquifers are presented in the alluvial sediments of the narrow valleys of the multiple narrow tributaries in this region. Those small water conduit aquifers serve as important sources of potable water for the communities of Shvanidzor and Newvad, which utilize surface alluvial groundwaters through ancient aquifer wells (penetrating hatches).

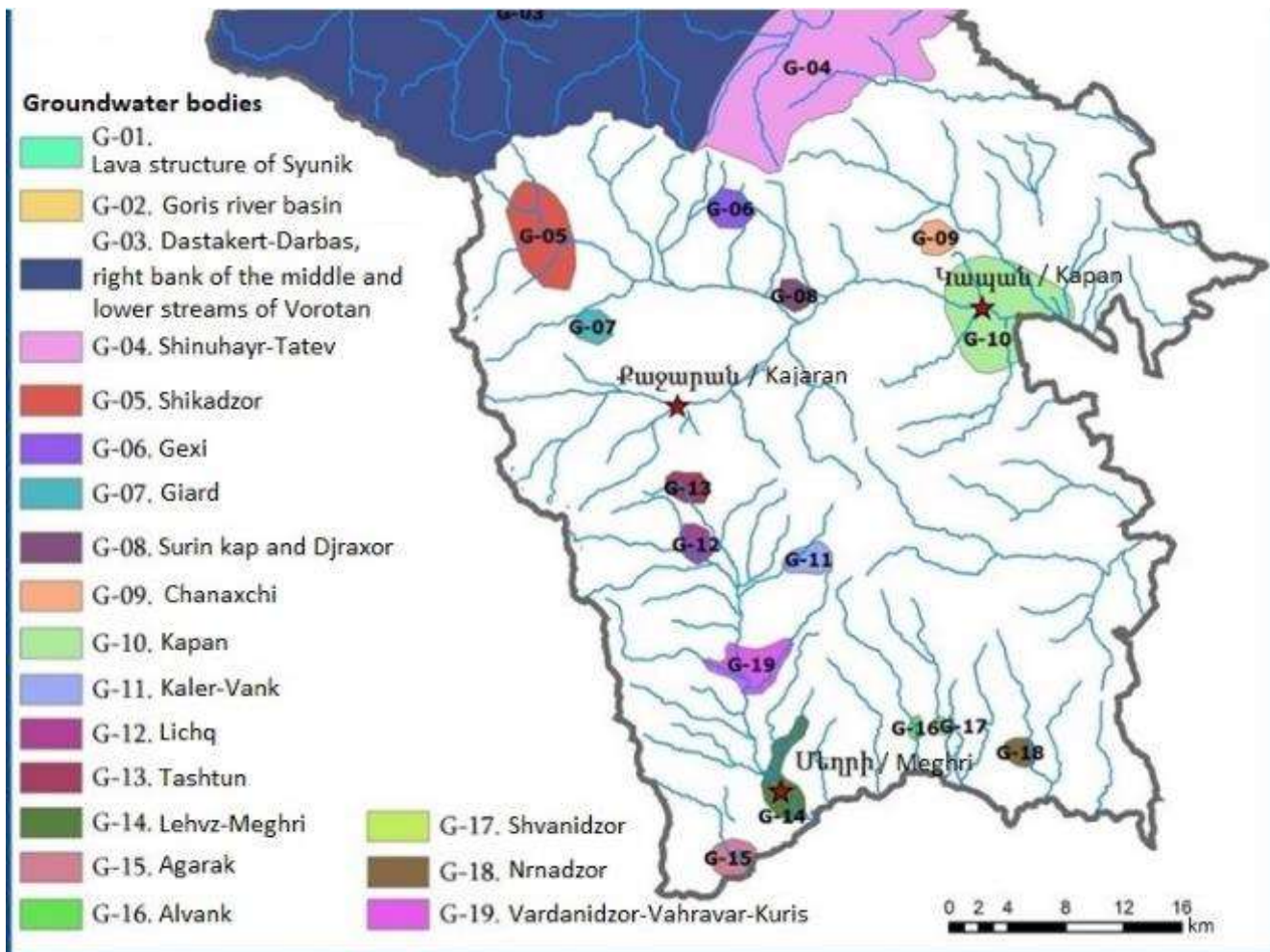


Figure 15: Map of groundwaters of the hydrological basins of the Voghji and Meghri rivers

The floodplain of the Araks river has alluvial water conduit aquifers in some sections. The water conduit aquifer located adjacent to the floodplain of Agarak is operated with several local and industrial wells.



The self-reliant sources of the section of Tashtun-Lichk are entirely being used. There are some sources in the section of Kaler-Vank which are not being used.

There is a source with up to 20 l/s flow rate in the upper courses of the Meghri river. There are mineral sources in the middle and lower courses of the Meghri river (registration number: 104 (Lichk) and 105 (Meghri), 106-108).

Potable water supply and drainage issues and irrigation water supply

Water supply and drainage services are operating in civil communities located in the Meghri river basin. The majority of the potable water supply systems are worn out; they are gravity fed systems operating with great loss. More than 60% of the potable water supply of the territory of Meghri is supplied by two gravity fed systems – Zvar gravity fed system which supplies water to the town of Meghri and its neighbouring communities, and Boghakar gravity fed system which supplies water to Agarak and its neighbouring communities. The deep well system located in Agarak is operating, taking water from the water conduit aquifer of the Araks river floodplain.

Due to the 13 small surface and groundwater supply systems, nearly 100% of the population of the rural areas are also supplied with potable water. The rural areas are not sewerred, and the urban systems of Kajaran, Meghri and Agarak, although being sewerred, do not have an operating wastewater cleaning system in place.

Irrigation channels of local significance are operating in the basin of the Meghri river, which are old and work with considerable loss; they need repair, however, in general, they meet the irrigation needs of agriculture. Those systems are gravity fed and are fed by the Meghri river and its tributaries. The irrigation water of Nrnadzor, Shvanidzor, Alvank, and Araksashen communities is supplied through pumping stations from the Araks river.

Topography, geology, soil, and seismology

The RA territory occupies the north-eastern part of the Armenian plateau which is composed of young corrugated mountain chains formed as a result of alpien mountain formation processes, which is called Lesser Caucasus, as well as massifs of volanic formation located in the north-eastern part of the Armenian volcanic plateau (Aragats, Ara, Hatis, and Geghama, etc.). The terrain of the about 45 km Kajaran-Agarak road section is entirely located in Syunik region and characterized by highly complex and diverse topography. It combines fold, coulisse-shaped and linearly stretched mountain ranges, volcanic massifs, upland plateaus, intermountain concavities, and river valleys. Mountain slopes are intensively weathered (eroded).

Some volcanic terrains have been observed in the project area, especially between the KP 352.7 and 357.5 of the existing road (in the surrounding of Lichk village). Different facieses have been observed in the cutslopes of



the existing road: pyroclastics (including ashes), lava flows, breccia, volcanic sediments (mudflows, tufs), but also a few rocky formations like dacite or andesite.

This area is characterized by great variability and heterogeneity of the facieses, with several changes of nature of the terrains on short distances. Nevertheless, these terrains have currently a soil behaviour and are characterized by gentler slopes in the landscape. Some landslides have been observed on the downward of the existing road, near KP 353.5.

Besides, some other types of terrains as alluvial terraces and granitoid plutons are also present in the area where the volcanic terrains are encountered, leading to a complex geology.

The project avoids the main area where the volcanic terrains have been observed along the existing road, as the alignment is located on the opposite side of the Meghri river valley. Nevertheless, it cannot be excluded that the same type of terrains would exist in a few areas at the footprint of the alignment (especially where the alignment is located far from the existing road and where no site visit was possible). In particular, some red outcrops have been observed near the KP 20 of the project in the upper part of the slope and it might be volcanic terrains. In this area, slope reduction could be possible, without great consequence on overall quantities.

Genetic types of relief

- 1) Edge tablelands (1100-2200 m) on slightly steeped corrugated formations (from Meghri M-2 highway to the gorge of the Vorotan river).
- 2) Northern, eastern and southern slopes of the eastern wing of the Zangezur mountain chain (towards north of Kajaran) with steep slopes (up to 25-35°) and slightly grooved watersheds.

The following types of relief are common:

1. Lava flows (classic type)
2. Partial landfalls in the surroundings of the projected highway

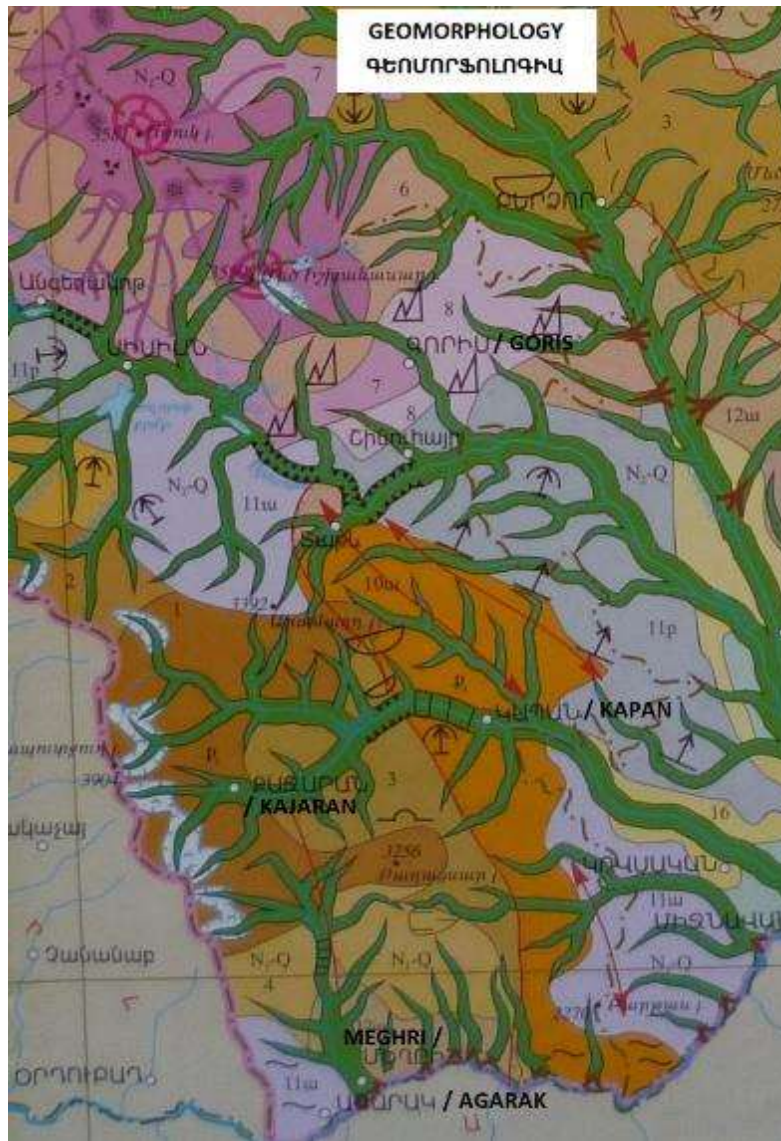


Figure 16: Geomorphology of the region of Syunik (RA National Atlas, Volume 1, Yerevan, 2007)

Geology

The territory has a steep relief, moreover, the lowest point is 375 m, which is located in the valley of the Araks river, and the highest point is 3904 m (mount Kaputjugh peak) (the highest points are Kaputjugh, Sisakatar and Gazanaler). The territory is mostly composed of granite and other intrusive rock faces of the Tertiary (Cenozoic) period, however, the small area located in the north is characterized by a sedimentary geological structure.



The geological structure of the territory is represented in formations of the Eocene and Quaternary periods. The oldest rock faces of the territory are gabbro-diorites and middle Eocene gabbro-syenite rock faces which are widely common in the left bank slope of the Meghri river and in the river-bed borders.

These intrusive rock faces of the Eocene period are covered with sedimentary soil from the Quaternary period, which are represented in large and small rock debris, gravels and alluvial (*riverine*) and delluvial (originated as a result of floods) loam with a total width of 6.0-10.0 m (sometimes 18-20 m in terraces – riverine/alluvial coarse gravel).

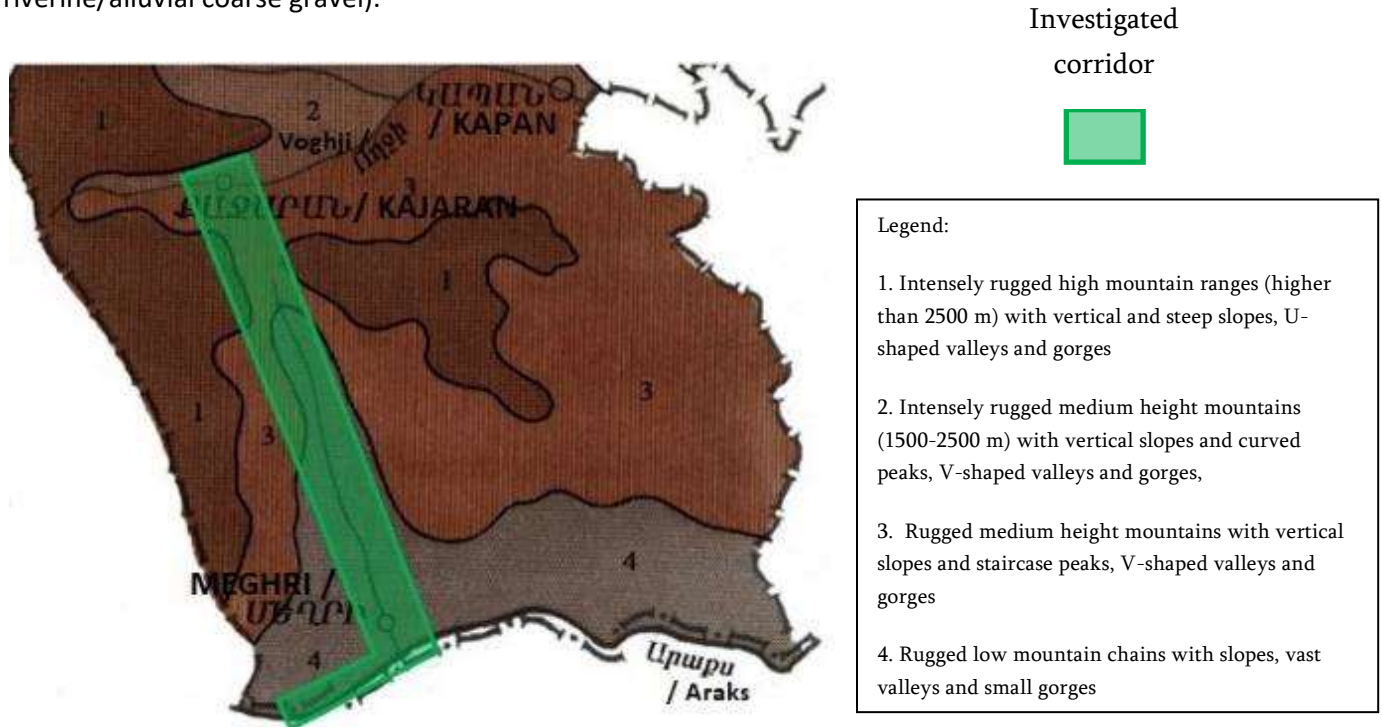


Figure 17: The geological structure of the territory

The plateau of Meghri has a predominant role in the geology of the area which spreads from the Voghji river (Kajaran) up to the border with Iran (Meghri-Agarak). This geological formation is made of granitoid rock faces, including monzonites, syenites, syenite-diorites, and gabbro-diorites. However, the types of rock faces will not be as important for the geotechnical design, as the fracture and aeration descriptions of the rock faces. Indeed, as we can see, presently there are numerous oscillations of density and fracture types, as well as aeration along the road. However, the typographies are mostly made of rocky geological materials (rock faces which are more than solid), due to the upper layer of soil which is not too thick. In some areas, the aeration process is more developed, especially along fractures of tectonic character (cracks) resulting in the presence of aerated rock faces and even soil ground. In general, the thickness of the grounds remains little (1 or 2 m) in sections closer to the surface (granitoid arenization (turning into soil), which creates soil terrains), however its significance may increase in the case of lesser steep slopes. Summing up, it is worth mentioning that the prevailing facies is presented with thick and fractured rock faces.



The Vorotan river-bed and sediment, as well as the terraces are made of lake, fluvial, proluvial sediments of the upper Pliocene period (3,3 – 0.01, actual age – during 1 mil. years).

Gabbro, granodiorite, quartz diorite, monazite, nepheline syonite, and leicogranite from the Eocene period (42-38 mil. years old) can also be spotted near the entrance of Kajaran.

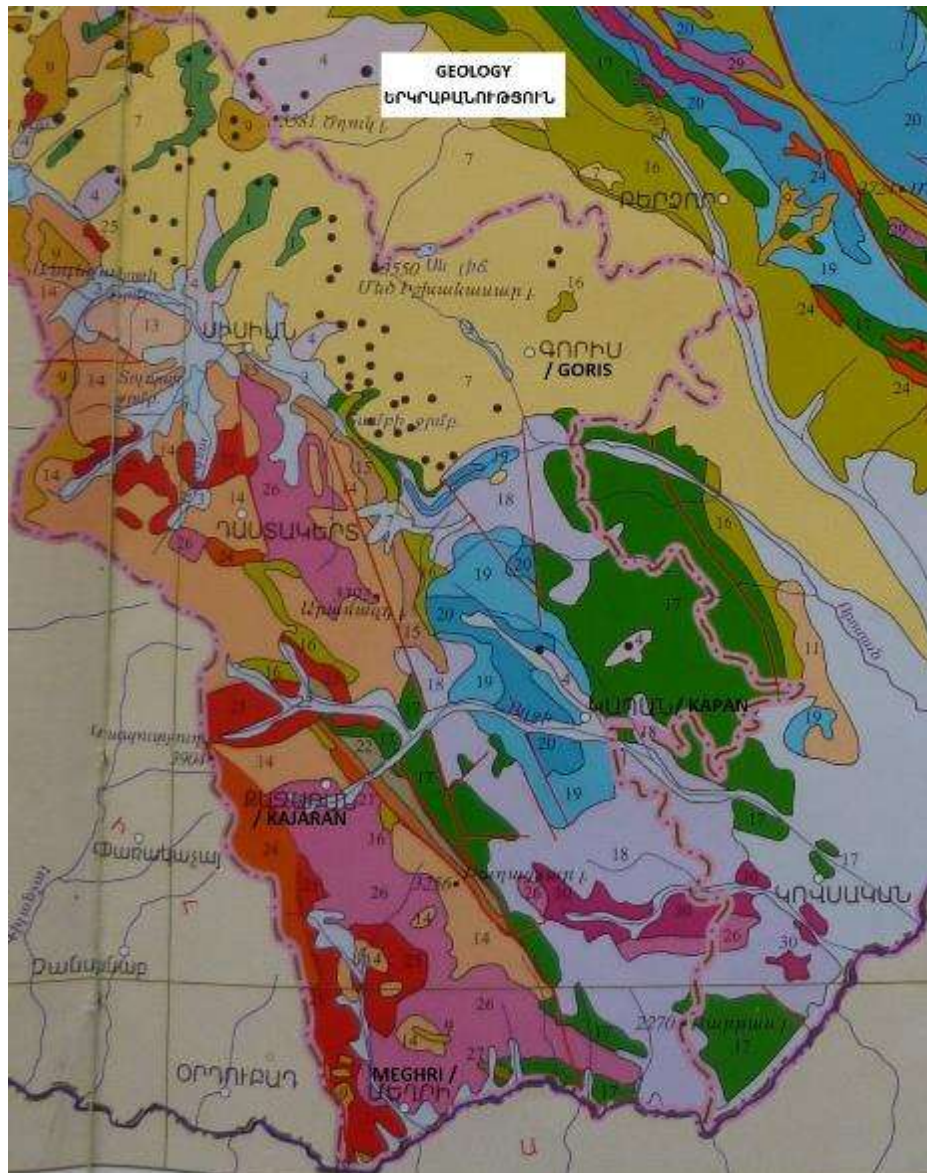


Figure 18: Geologic map of the region of Syunik (RA National Atlas, Volume A, Yerevan, 2007)

**Soil: Soil description**

The soil is formed under the influence of a number of factors which include: soil forming rock faces, flora and fauna organisms, climate, relief, time, water, and human economic activities. The soil types and sub-types formed under the impact of these natural and geographic factors in mountainous countries, such as Armenia, to some extents are connected with upland landscape zones and create *upland zoning of soil types*. The zoning distribution of soil types can also be vividly noticed along the entire North-South highway section of Kajaran-Agarak. The main types of soil of the section from Tashtun mountain pass to the valleys of Kajaran and Araks, from top to bottom, alternate in the following sequence: *meadow-steppe soil*, *umber soil*, and *river-bed-terrace soil* prevail in the section from the Meghri river course to the Araks valley.

Meadow-steppe soil prevails in the area requested for the highway section of Kajaran-Agarak, from the borders of the village of Tashtun to the tunnel exit, the valley of the Meghri river (1920 m.a.s.l.), and upper areas.

Meadow-steppe soil occupies the Armenian volcanic plateau at an elevation 2100 – 2600 m. They originate under the conditions of temperate humid, cool summer, cold winter and deep snow cover climate and meadow-steppe vegetation covers. *Lithological type of soil* mostly consists of rock faces. Sub-types similar to blacksoil (used as meadow-land) and typical blacksoil (used as pasture) are distinguished in this type. Humus composition is 10-13%, they have mild acid reaction, and the cationic exchange capacity reaches 57 mg /eq. The *typical meadow-steppe residual unsaturated soil* sub-type prevails in these elevations in the area requested for the highway.

The *Umbur type* of soil prevails on the lower border from the tunnel entrance to Lernadzor and from Tashtun to Lehvaz, with the following sub-types: before the tunnel entrance: *forest umber decalcified steppe*, in the section of Tashtun – Vardanidzor – *forest umber typical steppe*, and in the section of Vardanidzor – Lehvaz – *forest umber carbonate steppe*.

The *forest umber soil type* originated in a temperate warm climate, generally under Quercus, Carpinus and Acer forest covers, on porphyrites, granodiorites, limestones, sandstones, and aerated materials, as well as on dealluvial loam and clay piles.

Soil of this type is common on the eastern slopes of mountain chains, on an elevation of 900-2400 m. They can also be spotted on mountain slopes with different fragmentations and slightly steeped plateaus, and can be distinguished by cavitation, substantial stoniness, and loamy mechanical composition. The humus composition in this type of soil is 4-6 %, it has neutral or mild base (pH=7-8.2) reaction of *soil water extract*, medium and higher *capacity of cationic exchange* (30- 44 mg/a/s), considerable number of carbonates, and favorable hydro-physical features. The greater part of this soil is transformed into steppe soil on different levels (the lower, the more steppe-transformed) and is mostly used as arable land, meadow lands, and pastures. The bio-climate characteristics of the *forest umber soil* formation contribute to the good growth of forest plant compositions and the formation of plant biomass and greensward in great quantity.



River valley-terrace sub-type of the steppe soil type prevails on the highway section of Lehvaz-Meghri-Agarak.

River valley-terrace soil sub-types formed in the valleys of large rivers. Genealogical aquifers are mildly expressed in *river valley-terrace* soils. They have a very simple layered structure, great intensity and a light mechanical composition (soil and loam) and granular structure. The river valley-terrace soil has improved technological granules, and its adhesiveness, connectivity, and specific resistance is not considerable. The humus composition is 1.5-2 – 4-6% (the humus composition is higher on elevated lands), it includes a considerable amount of absorbed magnesium, the acidity of water extract is pH=6,9-8,1, and the volume of natrium absorption is 14-35 mg/eq. The soil is generally irrigable and abundant in crop, if it is utilized properly.

Meadow gravel version of the river valley-terrace soil subtype prevails in the highway section of Lehvaz-Meghri-Agarak.

The *intensity of topsoil layer* greatly varies on different sections of the highway. It depends on the degree of steepness of the slope, its position, nature of the ground rock faces, and the height above sea level. For example, the intensity of the topsoil layers of the southern positioned slopes is insignificant (total of 1-2 cm) near the peaks; it can reach 10-13 cm and more in valley edges and gorges. North facing slopes are less aerated: the intensity of topsoil layers may reach 10 cm near the peaks, and it may reach 15-20 cm in valley edges. The intensity of topsoil layer and vegetation abundance are interconnected. The situation is the same in lower locations, however, the intensity of topsoil layers here significantly exceeds the index of highland locations reaching 15-25 cm on north-facing slopes.

Genealogy of soil-forming rock face sediments and their lithological composition

The valleys of the middle and lower courses of the Voghji and Meghri rivers are covered with modern river-bed, terraces and articulation cone proluvial (torrential) and alluvial (riverine)-proluvial sediments, the lithological composition of the soil-forming rock face includes sand, loam, rubbel, gravel, and boulders with sandstone appearance. The soil in the upper courses of the Meghri river have diluvial (sloping) and diluvial-proluvial genetic type of sediment. The lithological composition of their soil-forming rock faces includes loam, till, breakstones, and boulders. There are also landslide and solifluction locations in those areas.

Degree of soil erosion

The degree of soil erosion is high (III-IV, 25-45%) in the area requested for the North-South highway section of Kajaran-Agarak. The reason is that the M2 interstate highway passes through the valley of the Meghri river, and several communities are situated nearby, and the mining industry is quite developed in this region. Except for those low-set areas, the soil is in an intense agricultural circulation surrounding the Yerevan-Meghri highway and is utilized mostly as arable land and mostly accessible rural area pastures. The degree of soil erosion is II (1-10%) in meadow lands and elevated pastures.

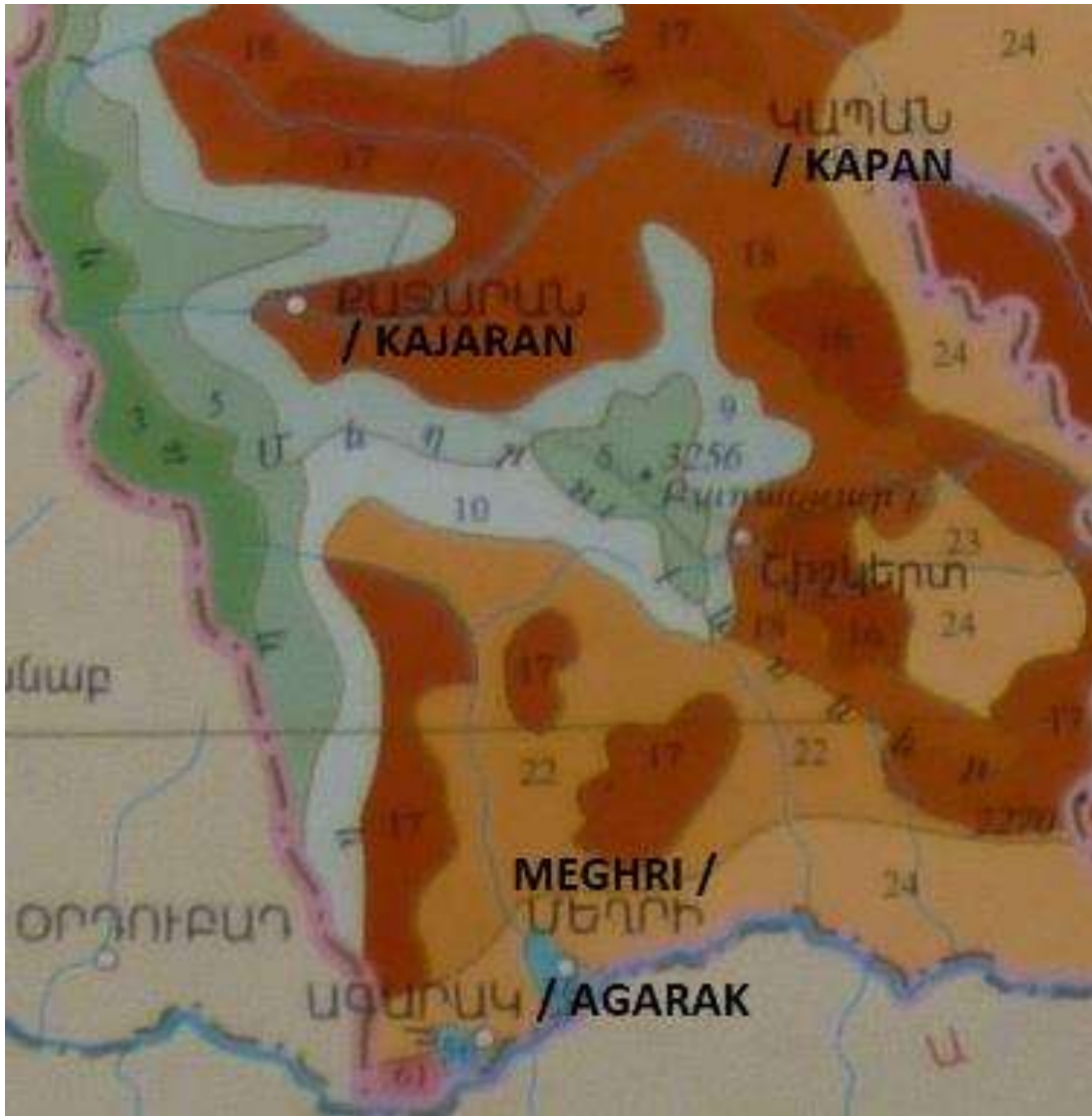


Figure 19: Map of the soil cover of the Kajaran-Meghri territory. The following soil sub-types are indicated in numbers: 18 –Forest umber decalcified steppe, 9-Meadow-steppe typical residual unsaturated, 10-Meadow-steppe typical breakstone, 22-Forest umber typical steppe, 24 –Forest umber carbonate steppe, 56- River-bed-terrace meadow gravel



Figure 20: Soil profile in the Meghri river valley



Schematic map of dissemination of soil-forming rocks

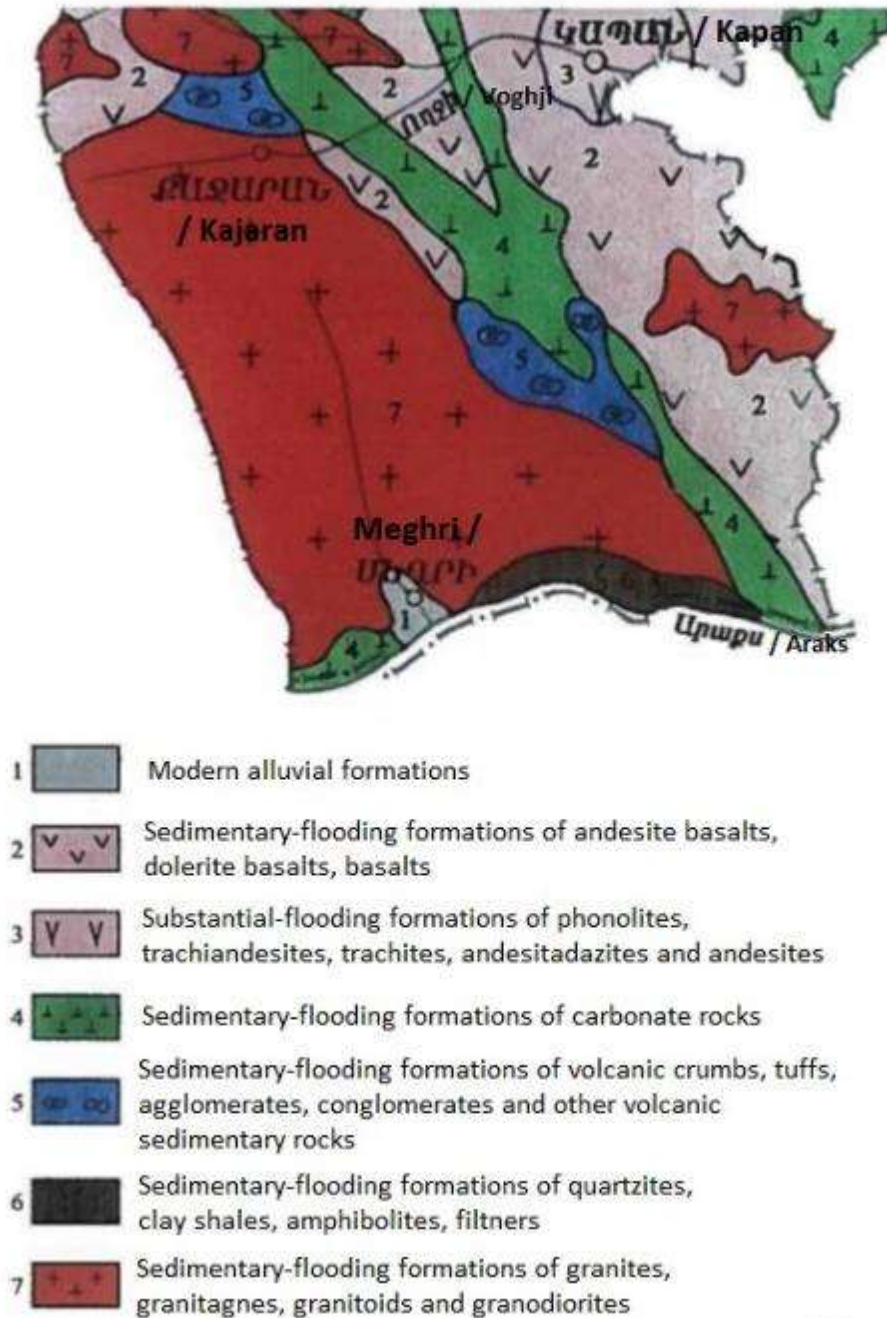


Figure 21: Schematic map of soil-forming rock face distribution



Seismotectonics. From the perspective of tectonics this area is included in the Tsaghkunyats-Zangezur (Meghri) anticlinorium zone. The zone borders with Shirak-Zangezur from the north-eastern side and with Ani-Ordubadi tectonic deep fractures from the south-western side. The main mountain-forming processes of this zone have been observed in the region of the Pyrenean folds (eocene-miocene); the erosion surface was formed in the mid-upper Pliocene, partly also in the Quaternary period.

Possible earthquake magnitude in the described area is 6-8 points, the maximum horizontal accelerations being 0,3-0,5g (data obtained from the National Seismic Protection Service).



Figure 22: Seismic zoning map of the region of Syunik, RA National Atlas, Volume A, Yerevan, 2007

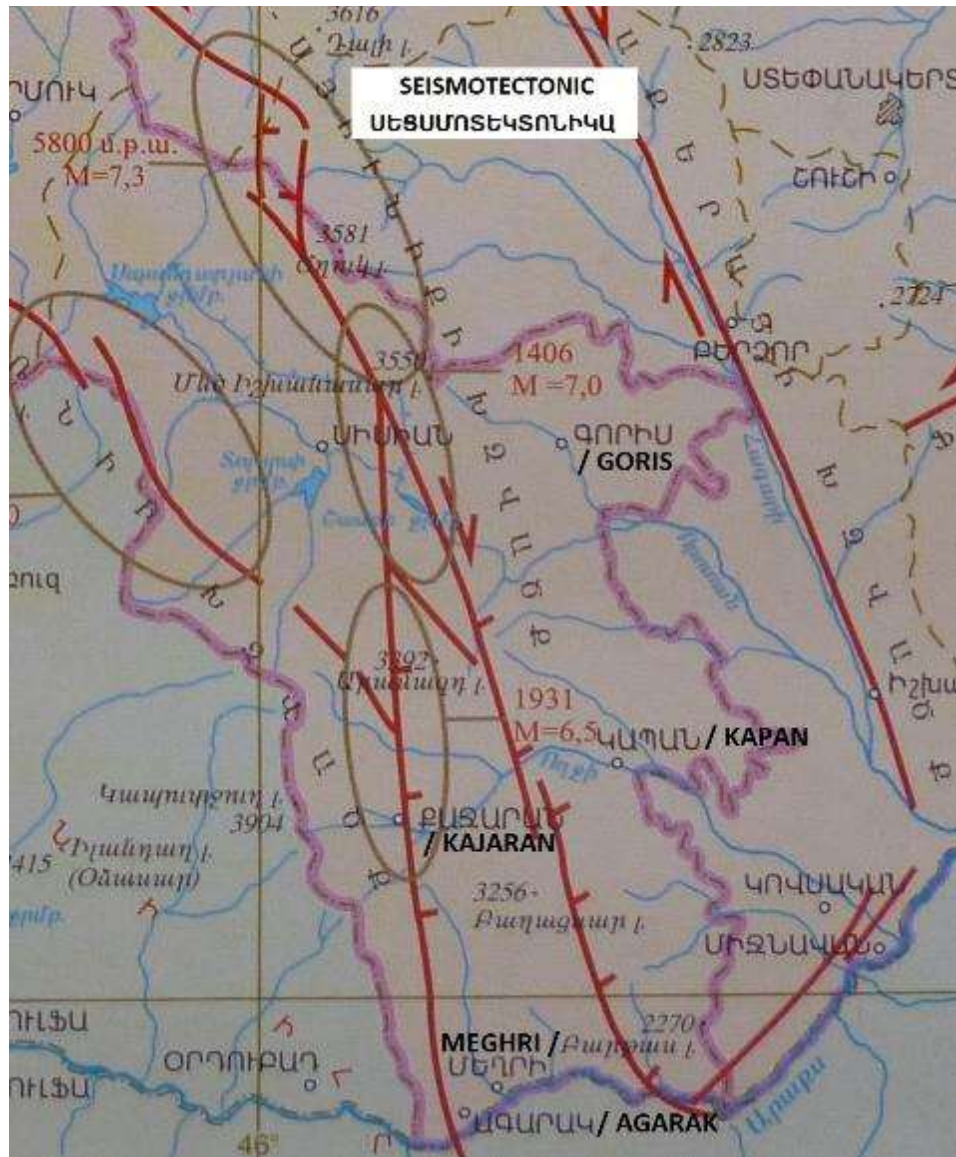


Figure 23: Seismotectonic map of the RA region of Syunik, RA National Atlas, Volume A, Yerevan, 2007

Landslides: landslides are mostly typical of the upper and middle course basins of the rivers of Sisian, Voghji and Geghi. There are threats of landslides in the southern part of the region of Syunik. Around 11 locations with the threat of landslides were identified on the highway from Meghri to Kajaran, along the Meghri river in 1994. Mud waters also pose a threat for this area and they were found in several locations of the southern parts of the region of Syunik.



Figure 24: Landslide distribution map (region of Syunik), RA National Atlas, Volume A, Yerevan, 2007

Harmful mud water flows were observed during the soviet years in Meghri, Agarak, Lehvaz, Karchevan, Vardanidzor, and other locations. All the protective measures taken since 1970 have made it possible to reduce the vulnerability of those areas.

The highest flood was registered in 1956 on the Meghri river (according to the information provided in the records made during 61 years) and was 87.5 m³/s in the hydrometric station of Meghri (274 km²). It equals to the 0,32 m³/s/km² flow module, which is approximately equivalent to 2% probability.



Landslides of Basins of Meghriget River and Adjacent Small Tributaries of Araks River

Scale 1:200,000

Developed by Geocom Ltd.
Based on published data

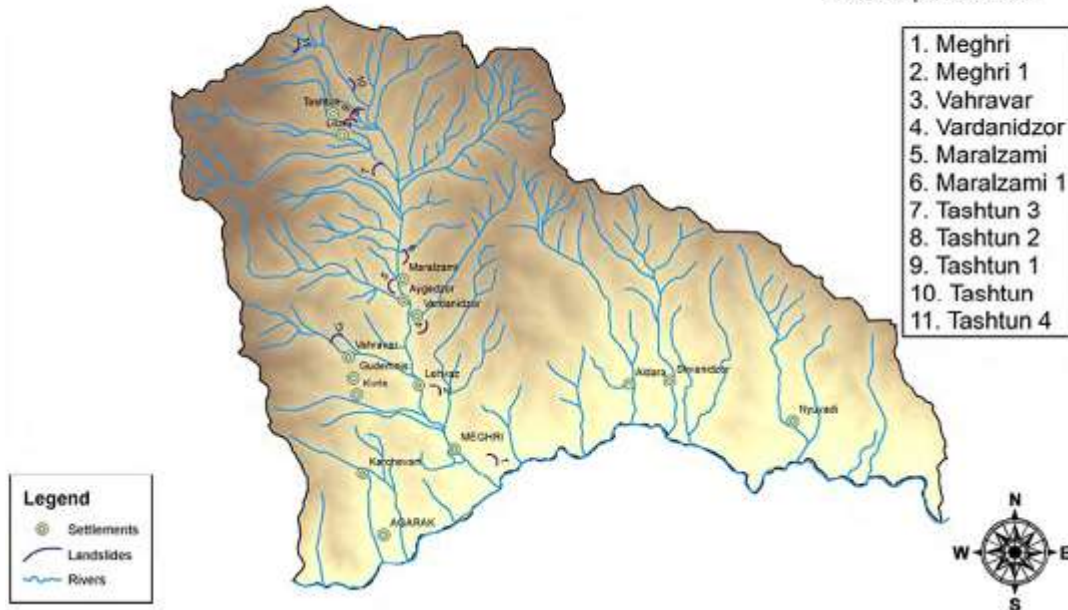


Figure 25: Landslides in the basins of the Meghriget river and adjacent small tributaries of the Araks river

Mudflows: the designed road section is completely located in the mudflow of a medium active basin (muddy mudflows occur every 3-10 years).

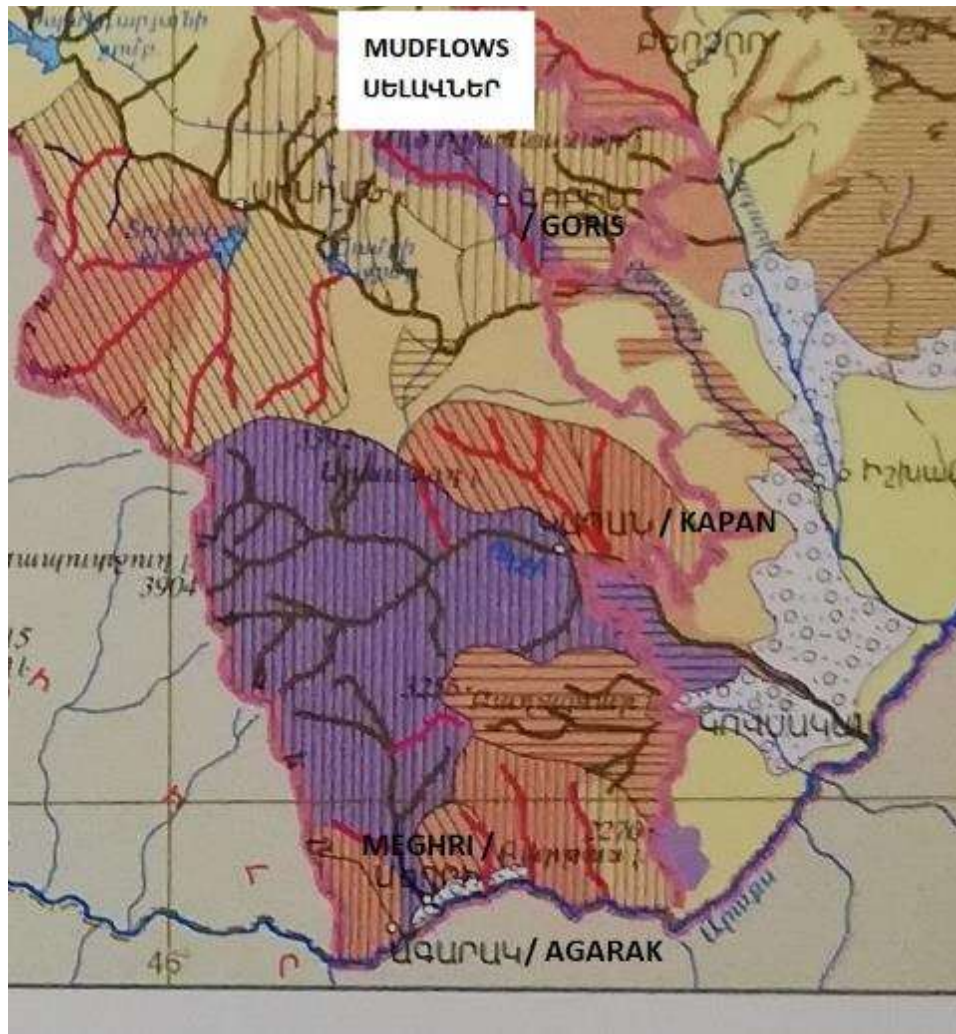


Figure 26: Map of mudflows of the region of Syunik, RA National Atlas, Volume A, Yerevan, 2007

Erosion: Erosions are mainly due to anthropogenic effects. The degree of soil erosion in the area requested for the Kajaran-Agarak section of the North-South highway is high (III-IV, 25-45%). The reason is that the M2 interstate highway passes through the Meghri River valley, there are several settlements here, the mining industry is developed in the region. In addition, in the lowlands, near the Yerevan-Meghri highway, the land is in intensive agricultural circulation, mainly as arable land, more accessible to rural pastures. Soil erosion is grade II in grasslands / 1-10% /, and high mountain pastures.



4.2 ENVIRONMENTAL RESOURCES

4.2.1 Flora

The area requested for the construction of the Kajaran-Agarak section, as envisaged by the North-South highway project, is located in the Syunik province, and the project impact zone includes the southern parts of the floristic area of Zangezur and certain areas of Meghri's floristic region.

The following vegetation types can be found in the floristic area of Zangezur: semi-deserts, forest, steppes, sparse forests, meadows, the height borders are on 600-3900 m.a.s.l., the number of the growing plant species is 2000, of which 41 are endemic and 95 are registered in the Red Book.

The following vegetation types can be found in the floristic area of Meghri: semi-deserts, forests, sparse forests, meadows, the height borders are on 400-3100 m.a.s.l., the number of the growing plant species is 1680, of which 26 are endemic, and 112 are registered in the Red Book.

Since the impact zone of the requested area does not fully occupy floristic areas, steppes, mountainous and sub-alpine meadows are not common here. The following vegetation types can be found:

- Deciduous forests (Quercus-Carpinus, Carpinus-Quercus, Quercus-Carpinus-Acer and other coexistences and riverbed forests)
- Sparse forests (deciduous sparse forests, mixed sparse forests, coniferous sparse forests (Juniperus))
- Shibliak
- Drought-tolerant mountain – phrygian (mountain-xerophile) vegetation (tragacanth shrubs, mountain xerophyte scrubs)
- Semi-deserts

Besides the indicated vegetation types, introzonal vegetation types are also common in the requested area:

- Swamp vegetation (coastal vegetation, vegetation floating in water (water vegetation))
- Petrophile vegetation

The route of the highway, as envisaged by the project, nearly entirely (except the tunnel section) passes first along the valley of river Voghji, and then Meghri river, with numerous ponds.



Spiraea crenata



Juniperus L.



Paliurus spina-christi



Anacardiaceae



Rhamnus Spathulitolia



Stachys, Lamioideae



Deciduous forests

In the requested area, the forests are mostly distributed on highly steeped slopes (30% and more). Forest coexistences with prevalence of *Quercus* and *Carpinus* are mostly common. A broad-leaved forest with prevalence of *Quercus* can be found in the section bypassing the village of Lernadzor and the first tunnel exit, on the right bank hillsides of river Meghri. A deciduous forest with prevalence of *Carpinus* can be found on the right-side hills of the canyon of the river of Gozgoz, up to the section of the second tunnel entrance.

Riverbed forests

The route of the highway, as envisaged by the project, passes a significant distance (except the tunnel section and the right hillsides of river Meghri) first along the canyon of the river Voghji, then Gozgoz, and then Meghri, afterwards flowing through the vally of river Meghri.

The riverbed forests, with the whole understanding of the term, are absent in Armenia, however, in certain areas, depending on the streambed of the river, the width of canyons, forest layers are formed on river banks which vary in different territories in Armenia by plant vegetation composition; they form riverbed forest layers.

Sparse forests

Deciduous forests

The deciduous sparse forests have quite an abundant plant composition. From the Poaceae, *Quercus iberica* Stev. can be found here, and in lower areas you can find *Quercus araxina* (Trautv.) Grossh. From the Ulmaceae, *Celtis planchoniaca* Waldst. et Kit., *U. minor* Mill., from the Moraceae, *Morus alba* L., from the Aceraceae, *Acer campestre* L., *Acer ibericum* M. Bieb., from the Cornaceae, *Swida australis* (C.A. Mey.) Pojark., from the Eleagnaceae, *Eleagnus angustifolia* L., *Jasminum fruticans* L., from the Caprifoliaceae, *Lonicera iberica* M. Bieb., *Viburnum lantana* L., from the Rosaceae, *Spiraea crenata* L., *Spiraea hypericifolia* L., *Rubus caesius* L., *Rosa spinosissima* L., *Rosa iberica* Stev., *Rosa canina* L., *Cotoneaster integerrima* Medik., *Pyrus salicifolia* Pall., *Pyrus medvedevii* Rubtzov, *Malus orientalis* Uglitzkitch, *Mespilus germanica* L., *Crataegus armena* Pojark., *Crataegus orientalis* Pall., *Crataegus meyeri* Pojark., *Prunus spinosa* L., *Prunus divaricate* Ldb., *Amygdalus fenzliana* (Fritsch.) Lipski, *Amygdalus nairica* Frd. et Takht., *Cerasus incana* (Pall.) Spach., and *Cerasus mahaleb* (L.) Mill., from the Anacardiaceae, *Pistacia atlantica* subsp. *mutica* (Fisch. et Mey) Rech., from the Berberidaceae, *Berberis orientalis* C. Schneid., from the Grossulariaceae, *Ribes orientale* Dsf., from the Rhamnaceae, *Rhamnus pallasii* Fisch, et C.A. Mey., from the Anacardiaceae, *Pistacia mtlantica* Desf. subsp. *mutica* (Fisch, et Meyer), *Cotinus cogtgria* Scop., and *Rhus coriaria* L., etc. can be found.

Mixed sparse forests

Besides the deciduous sparse forests, mixed sparse forests can also found here with participation of *Juniperus oblonga* M. Bieb, *Juniperus polycarpos* K.Koch, and *Juniperus foetidissima* Willd. Here, representatives typical of the local sparse forests – mostly shrubs and padded types can be found.

Coniferous sparse forests (Juniperus)

Juniperus sparse forests are formed from one or several sub-species of *Juniperus*. In the requested are the following species can be found: from the Cupressaceae, *Juniperus oblonga* M. Bieb, *Juniperus polycarpos* K.Koch, and *Juniperus foetidissima* Willd. The main forest-forming species is *Juniperus polycarpos*. In certain



areas, we can come across with plain Juniperus forests, where, besides Juniperus polycarpus, Juniperus oblonga Bieb and Juniperus foetidissima grow in small quantities.

Shibliak

One of the phytocenoses identified in similar ecological conditions of dry sparse forests is shibliak, where Paliurus spina-christi Mill. is considered an edifier. Shibliak has a secondary origin – it originates in the location of the forests destroyed by humans.

Here, along with Paliurus spina-christi, the following species can be found as well: Berberis orientalis C. Schneid. from the Berberidaceae, Pistacia atlantica subsp. mutica (Fisch. et Mey) Rech., Rhus coriaria L. from the Anacardiaceae, Tamarix ramosissima Ledeb. from the Tamaricaceae, Punica granatum L. from the Punicaceae, Rhamnus pallasii Fisch. et C.A.Mey. from the Rhamnaceae, Rosa spinosissima L., Rosa iberica Stev., Cotoneaster integerrima Medik., Cerasus incana (Pall.) Spach., Spiraea crenata L., and Spiraea hypericifolia L. from the Rosaceae, and Ficus carica L. from the Moraceae, etc.

Drought-tolerant mountain – phrygian vegetation

Tragacanth shrubs

Sections of tragacanth shrubs can be found in the requested area, where Asrtagalus aureus W. is considered an edifier. The main type of plants common in the grass cover are drought-tolerant plant species.

Mountain xerophyte scrubs

Sections of mountain-xerophyte vegetation can be found on the hillsides, which have a rich plant composition. These sections follow the forests and sparse forests along the road.

Semi-desert vegetation

The semi-desert vegetation can be found in narrow layers, above the valley of river Araks, at the foot of the steep rock slopes. Asteraceae semi-deserts are one of the main formations, with the participation of Artemisia fragrans Willd. At some parts, Asteraceae semi-deserts can be found in small sections, with the participation of Salsola dendroides Pall.

Intrazonal vegetation

Swamp vegetation

Riverbed vegetation

There are no lakes and ponds in the requested area, however, rivers Voghji and Meghri, along with their tributaries flowing down the area, the banks of which are abundant in mesophile vegetation; there are also superhumid sections.

Vegetation flowing in the water (water vegetation)

From the Potamogetonaceae, Potamogeton nutans L. and from the Butomaceae, Butomus umbellatus L. can be found between the residential areas of Meghri and Lehvaz.

Petrophile vegetation

There are no landslides (chingsils) and rockfalls in the requested area. There are some rocks in the cracks of which plant species of different families grow.



The detailed description of flora, as well as a number of plant species, which are considered endangered and have been registered in the Red Book of Plants of Armenia, and can be found adjacent to the study areas, are presented in Annex 6.

4.2.2 Tree-shrub vegetation

Numerous tree-lined and shrub-lined areas will be impacted as a result of the implementation of the Kajaran-Agarak road section project of the North-South highway. Below please find the data obtained during respective studies regarding the logged trees and shrubs in the area:

Brief description of the area

The section of Kajaran-Vardanidzor of the North-South highway starts from the administrative area of the village of Lernadzor, passing through the route of M2 interstate highway. From the village of Lernadzor it enters a tunnel of approximately 7,2 length, going through the maintain pass of Tashtun (2483 m) and getting to the forest-lined gorge of river Tashtun. Prior to reaching Vardanidzor, the routs of the envisaged project mostly goes through the route of the current road. In some cases, the constructed highway reaches forested areas, bypassing the residential areas, which will appear in the impact zone during the project implementation. The route of the envisaged project passes through different sections of rivers Tashtun and Meghri, the gorges of which have quite complicated relieves, the steepness of the slopes often exceed 30 degrees, and the forests mostly have a protection significance.

The section of Vardanidzor-Agarak of the North-South highway is located on a 540-100 m.a.s.l. From the upward landscape zones, it partially includes dry steppe low mountainous (1000-1600 m.a.s.l.) and semi-desert mountainous (500-1000 m.a.s.l.) zones.

The vegetation type is xerophile sparse forests (type 7 – sparse Juniperus forests, with the participation of Amygdalus fenzliana (Fritsch) Lipsky. From the Cerasus incana (Pall) Spach, shrubs Rhamnus pallasii Fisch. et Mey., Paliurus spina-christi Mill., Astragalus, Acantholimon, Onobrychis cornuta (L.) Desv., Salvia dracocephaloides Boiss., Thymus kotschyanus Boiss. et Hohen.), (and type 8) – Deciduous mixed, with the participation of Celtis glabrata Stev. ex Planch. Spiraea crenata L., Amugdalus fenzliana (Fritsch) Lipsky, Pistacia nutica Fisch. et Mey. Cerasus incana (Pall.) Spach, and Pyrus salicifolia Pall).

The main vegetation type in the surroundings of the town of Meghri and river Araks is of semi-desert mountainous – Asteraceae with the participation of Artemisia fragrans Willd., Kochia prostrata (L.) Schrad., Capparis spinosa Willd., Ceratoides papposa Botsch. et Ikonn., Atraphaxis spinosa L., Rhamnus pallasii Fisch. et Mey., Tanacetum argyrophyllum (C. Koch) Tzvel., Poa bulbosa L. Bromus, Aegilops, Eremopyrum, Alhagi, Alyssum, and Aeluropus littoralis (Gouan) Parl.

In the section of Vardanidzor-Agarak, the highway passes through the valley of river Meghri. Here the most common plant species are Tamarix ramossissima, Hippophae rhamnoides, Salix triandra, Salix elbursensis, Salix carpea, Rubus saxatilis, Epilobium hirsutum, Cynanchum acutum, Malva sylvestris, Mantha longifolia, Typha



domingensis, and *Lythnum saliaris*, etc. The following wild heat tolerant tree species can be found on river banks individually or in the form of small forests: *Morus*, *Ficus*, *Punica granatum*, *Juglans*, and *Vitis*.

From the point of view of geo-ecological bypassing, this section of the highway is situated in the basin of river Araks (II), in the region of Meghri (Arevik), and in the sub-region of river Meghri (39). There are numerous operating mines in the area, some of which are located in the valley of river Meghri. The ecological vulnerability rating of the area is "very vulnerable".

The highway of the region of Meghri mostly passes near "Arevik" National Park.

Forest area total space and tree calculation methodology

The forest and tree calculation methodology is selected based on the tree-shrub vegetation density, the size of the territory occupied by tree-shrub vegetation, the peculiarities of the location of the forest mass location relief, etc.

The tree-shrub vegetation subjected to impact does not form forest masses and is represented by individual trees, *groves*, in the forms of groups of trees, or they are not located on *forest soil*. In this case, it is possible to count the trees individually, by noting the tree species.

In separate cases, the tree-shrub vegetation occupies extremely steep (30-60%) hillsides, deep gorges and rocky canyons. Sometimes the tree-shrub vegetation forms impassable sections made of trees and shrubs on extremely steep gorges. In the indicated cases the total space occupied by tree-shrub vegetation is calculated with Google Earth program. The borders of the homogenous (approximately having the same foliage cover) tree-shrub mass is outlined (contoured) with the possibly larger scale and the total area of the outlined (contoured) space is calculated with the tools of Google Earth program. The respective specialist studies the composition of tree-shrub mass types, the density of the foliage, and the average space occupied by the foliage of individual trees. In special cases, it should be considered that recovering of forest foliage is possible in closed deciduous forests. The quantity of trees in dense forest masses is counted with the following formula:

$$TN = FT * FCC / TFS (1), \text{ where}$$

TN is the number of trees in the forest mass (contour),

FT is the contoured total area of the *forest territory*, m²,

FCC is the foliage cover coefficient (this number may have a value larger than 1 if foliage recovering exists),

TFS is the total space occupied by the foliage of a tree, m², which is calculated by the specialist by conducting an on-site study.

The concept of *forest space* is indicated in the respective decision of the government, which can be calculated from cadastral maps and/or by the above mentioned calculation (1) formula. The total area of a *forest space* of individual trees and/or group of trees that can be counted one by one, is calculated by the above-mentioned formula:



$$TN = FT * FCC / TFD (2)$$

Different types of *natural landscapes* can be found in the studied areas:

- a) Roads with two-side or one-side individual trees and shrubs,
- b) Forest-lined hillsides, often times with great steepness,
- c) Rocky forest-lined and shrub-lined hillsides,
- d) Cultivated and non-cultivated orchards,
- e) Rivers, fords,
- f) River valleys, covered with shrubs, individual trees or groups of trees,
- g) Dry hillsides covered with dry shrubs,
- h) Etc.

The counting of trees was done considering the peculiarities of the landscape. For example, forest masses which comply with the requirements of the term *forest*, have been divided into landfills and their total area was entirely calculated as a forest area. Shrub-lined areas were also calculated with the same principle. The results of all the calculations are summarized in the respective tables. For individual trees or groups of trees which were possible to count, such as in river valleys or road edges, their location was marked in the route with separate sections.

Tree and shrub species that appear in the project impact zone:

Oak tree (Lat. *Quercus*). A separate species of evergreen or deciduous trees of the Beech family, rarely – a separate breed of shrubs.

Q.macranthera. Is common in all the forest regions of Armenia, growing on 1200-1400 to 2400-2600 meters above sea level. It is heliophilous and humidity tolerant, freeze-proof, and soil demanding.

Ash tree (Lat. *Fraxinus excelsior*). These are large trees with a height of 25-35 (sometimes 40) m and with a trunk diameter of 1 m. The bark of young trees is green-greyish, it is flat, and later, as it grows, it obtains a dark greyish, cracked appearance.

Maple tree (Lat. *Acer*). A breed of deciduous trees or shrubs from Soapberry family. *Acer campestre* is a tree with a height of up to 16-18 m and with a trunk diameter of 40-50cm. It is an average long-living tree and lives up to 200 years. It is common in Caucasus, Western and Eastern Europe, and Asia Minor.

Chinese elm (Lat. *Ulmus parvifolia*). It is a tree with a height of 12-15 m and a trunk diameter of 1m. The foliage is dense and tent-shaped. The sprouts are delicate and bushy. The leaves are ellipse-shaped, oval-shaped or opposite–oval-shaped, with a length of 2-5 cm, sharp-edged or obtuse with uneven base, ordinary edge, flat and shiny/glossy on the top, and bushy on the bottom. Later it becomes pachydermatous (thick skinned almost like leather).

Bird cherry ordinary (Lat. *Padus racemosa*). Is a deciduous tree with a height of up to 17 m and a trunk diameter of 30-40 m. The layer is grayish and cracked. The layer of young branches and sprouts is shiny brown.

Plum tree (Lat. *Prunus cerasifera*). It is a small tree with a height of 4-10 m and a trunk diameter of 15-25 cm. The young branches are green, later they turn red-brown and have numerous shortened sprouts which end in thorns.



White willow (Lat. *Salix Alba*). It is a major deciduous tree with a height of 20-30 m and a trunk diameter of 3m, with a tent-shaped foliage. The layer is grey, covered with deep cracks. The edges of the young sprouts are silver and bushy, the older tree sprouts are bare/leafless.

Salix caprea. It is a tree species belonging to the Willow family. *Salix carpea* is a tree with a height of 8-10 m and a trunk diameter of 70 cm. In higher mountainous regions it grows as a big shrub. The sprouts are covered with grey bushes.

Common or Caucasian Hornbeam (Lat. *Carpinus caucasica*). Deciduous trees from the Betulaceae family, rarely it is represented as a shrub family. Two types are common in Armenia. They are widespread in RA mostly in the lower forest zones, in the south of Armenia.

Sorbus torminalis. Belongs to the Rose family, a plant of the apple family. It is a decorative fruit bearing tree with a height of up to 25 m.

Greek walnut tree (Lat. *Júglans*). It is a major deciduous tree, with a height of up to 30 m and a trunk diameter of up to 1,9 m. The layer of the trunk and old branches is uneven with a light grey color.

Oriental Plane tree (Lat. *Platanus orientalis*). It grows naturally in Armenia, is a deciduous strong tree with a height of up to 40 (50) m and a trunk diameter of 1.5-2.5 (3.5) m. It is heat-tolerant and humid-tolerant. It grows mostly in lowlands, in relatively humid areas.

The detailed count of tree-shrub vegetation growing in the project impact zone is presented in Annex 8 with maps and tables.

The order of carrying out construction and explosion works on forest soils, not related to running forestry and forest usage, mineral extraction, cable, pipeline and other communications, drilling and other works is defined by the decision of the RA government N1045-N dated 30.08.2007. Clause 8.1 of the decision defines the compensation amount of the damage caused to the forestry – carry out forestry works in the provided forest area (the logged forest) at least in the double quantity. Taking into consideration that the project is financed by the EDB, the tree-shrub vegetation should be restored with 1:6 relation, as prescribed by their requirements. Detailed information about tree restoring works is presented in Annex 8.

4.2.3 Fauna

The fauna of the southern regions of Armenia is greatly impacted by the zoogeographical region of Asia minor (which includes the foothills adjacent to the Kur-Araks lowlands), as a result of which certain animal species can be spotted in this particular region only. However, quite a few species which are common for other regions of Armenia as well, can also be spotted here. Aside from that, the abundance of fauna in the area requested for the North-South highway route greatly contributes to the diversity of nature elements and the route's distinction in great elevation. Moreover, due to the subtropical climate, the Araks valley can be a habitat for birds engaged in altitudinal (vertical) migration during cold months and a temporary rest stop for migratory birds.



All this results in a great diversity of fauna on the highway route.



Wild goat (*Capra aegagrus*)



Caucasian leopard (*Panthera pardus*)



Indian crested porcupine (*Hystrix indica*)



Armenian raddei (*Montivipera raddei*)

Invertebrates. Syunik region is rich in endemic species of fauna. In general, representatives of 70 categories of invertebrates are known in Syunik region. The largest number are insects, which are represented in the study area in 29 categories. The analysis of different publications on taxonomic groups Armenia fauna is allowed to identify 1735 species from Syunik region, which belong to the class of insects, the type of mollusks. Out of 153 endangered invertebrates registered in the Red Book of Armenia, 55 are represented in Syunik region (5 mollusks and 50 insects).

Amphibians and reptiles. From Amphibians, *Rana ridibunda* and *Bufo viridis* (green or variable toad) are common everywhere. *Rana macrocnemis* can be spotted on elevated zones and the upper flows of the Meghri river; *Hyla arborea shelkovnikovi* can be spotted in forest zones.

Reptiles mostly occupy the lower, xerophilus sparse forest natural green cover and rocky areas of the highway route where they can find food and nesting spots. From Lacertillia, *Pseudopus apodus* can be frequently spotted in gardens and forest glades, *Darevskia raddei* and *Lacerta media* can be spotted in rocky locations, stone fences and old walls. From Serpentes, *Macrovipera lebetina* is quite common here. The following table shows the list of amphibians and reptiles, the possibility of meeting them (distribution area) in the road plan project.



The observations of amphibians were carried out along the entire length of the projected road, as well as in the adjacent areas. Some inconveniences were caused by the fences made of dry metal branches of private lands. In some cases, it was not possible to identify the species of reptiles that quickly hid behind them. In many cases it was necessary to waste a lot of time waiting for the animal to rejoice or to walk around the whole area of the park.

Birds. There are birds along the entire route of the road which belong to 149 species and 49 families. Ploceidae are the most commonly encountered species, the birds of prey are the second most commonly found birds. It is worth mentioning that aside from their abundance, Passerines are also the most commonly nesting species throughout the entire route. Their nesting is connected with all the zones where the route is going to pass from the forest zone to the tunnel entrance and after getting out. The density of Passerines also enlarges in the intersection of Lichk-Tashtun villages, where the new route will pass along the forest slope of the gorge towards the second tunnel entrance. The passerine species composition starts changing to some extent from the second tunnel exit down the villatic village, which the new route will bypass on the right side. Instead of the species living in forest zones and fields, such as *L. arborea*, forest pony, *P. modularis*, *P. pyrrhula*, *S. rubetra*, *Periparus ater*, *Parus major*, *T. merula*, *C. chloris* and others, more drought-tolerant species appear, such as *T. torquatus*, *C. palumbus*, *Emberiza cia*, *Serinus pusillus*, *Phoenicurus phoenicurus*, *Phylloscopus sindianus*, and *E. rubecula*. *P. perdix* and *C. coturnix*, which are quite rare, can be found in not large sections of grasslands and forest massive glades.

Mammals. It is difficult to study mammals since the majority of them are camouflaged. It is often possible to make judgements about their presence by discovering the results of their vital activities (nests, excrement, traces of their vital activity impact on natural environment, etc).

From mammals, the following species live in the upper forests of the area adjacent to the highway route: *Felis lynx*, *Felis silvestris caucasica*, *Capreolus capreolus*, *Sus scrofa*, *Canis lupus*, and *Meles meles*, etc. *Lepus europaeus* and *Vulpes vulpes* prefer lower areas, dry slopes, shrubs, moreover, *Vulpes vulpes* has gradually got used to the human presence.

From rodents, it is possible to spot Arvicolinae, Dipodidae, *Mus caecus*, and Cricetinae in the investigated area.

27 species of mammals were discovered during the fieldworks. It is possible to spot *Martes foina* and *Mustela nivalis* in rock piles, *Erinaceus europaeus* in gardens, *Canis aureus* in cane fields, etc. The species composition of Hymenoptera, particularly Chiroptera, is quite diverse; the abundance of flying insects and cracks in rocks which serve as nesting spots, contribute to the diversity and the great number of their species (See Annex 6).

4.2.4 Specially protected nature areas

The region of Syunik has quite a developed and dense network of specially protected nature areas. The brief description of those SPNAs related to the Project is presented below:



“Arevik” National Park

- Date of establishment of the national park - decision of the RA Government N 1209-N, dated 15.10.2009
- The boundaries of the national park were verified and the total area was defined as 31211.19 ha, according to the decision of the RA Government N 731-N, dated 02.07.2015.
- Location - region of Syunik, southern slopes of Meghri mountain spur of the Zangezur mountain chain, on an elevation of 800-3000 m.a.s.l.
- Purpose of establishment – preservation, natural development, reproduction, and sustainable utilization of natural ecosystems, their biological and landscape diversity, natural resources, unique natural monuments, endemic and rare animal cross-border habitat environments in the catchment basins of Meghri, Shvanidzor and Newvad rivers
- Departmental subordination – RA Ministry of Environment and “Zangezur Biosphere Complex” SNCO.

“Zangezur” State Reserve

- Date of establishment of the reserve - 15.10.2009, by the decision of the RA Government N 1187-N
- A total area of 25711.6 ha of the reserve was defined by the decision of the RA Government N 731-N, dated 02.07.2015.
- Location – region of Syunik, southern slopes of the Bargushat mountain chain and eastern slopes of the Zangezur mountain chain, at an elevation of 2100-3500 m.a.s.l.
- Purpose of establishment – natural development, preservation, protection, restoration, and reproduction of Near Alpine meadow and meadow-steppe natural ecosystem landscapes and biodiversity, rare natural monuments, natural resources, as well as sustainable utilizing of natural and recreational resources
- Departmental subordination – RA Ministry of Environment and “Zangezur Biosphere Complex” SNCO

“Boghakari” State Preserve

- Date of establishment - 10.08.1989, by the decision of the Armenian SSR SS N 400
- Total area – 2728 ha
- Location – region of Syunik, territory of Meghri, slopes of the southern Zangezur mountain chain, Meghry forestry, at an elevation of 1400-2100 m.
- Purpose of establishment – representatives of the Armenian flora and fauna species, typical of this territory
- Departmental subordination – RA Ministry of Environment and “Zangezur Biosphere Complex” SNCO

Zangezur Biosphere Complex

“Zangezur” Biosphere Complex SNCO was established on December 19, 2013; it comprises an area of 79038,8009ha. The objective is to preserve, protect and reproduce its fauna and flora, natural ecosystems, landscape diversity, nature unique monuments, sustainable development of natural resources



“Zangezur” Biosphere Complex” SNCO comprises specially protected areas of the RA Syunik region; sanctuaries, a reserve and a national park. According to N929-Ն decree (08 September 2016) of the RA Government "Zangezur" Biosphere Complex "SNCO implements preservation works in the specially protected areas shown in the Table 8 and Figure 27.

Table 8: Target Protected Areas

PA name	Year of establishment	Size, ha
Arevik National Park	2009	31,211.13
Boghaqar State Sanctuary	1958	2,728.00
Zangezur State Sanctuary	2009	25,711.60

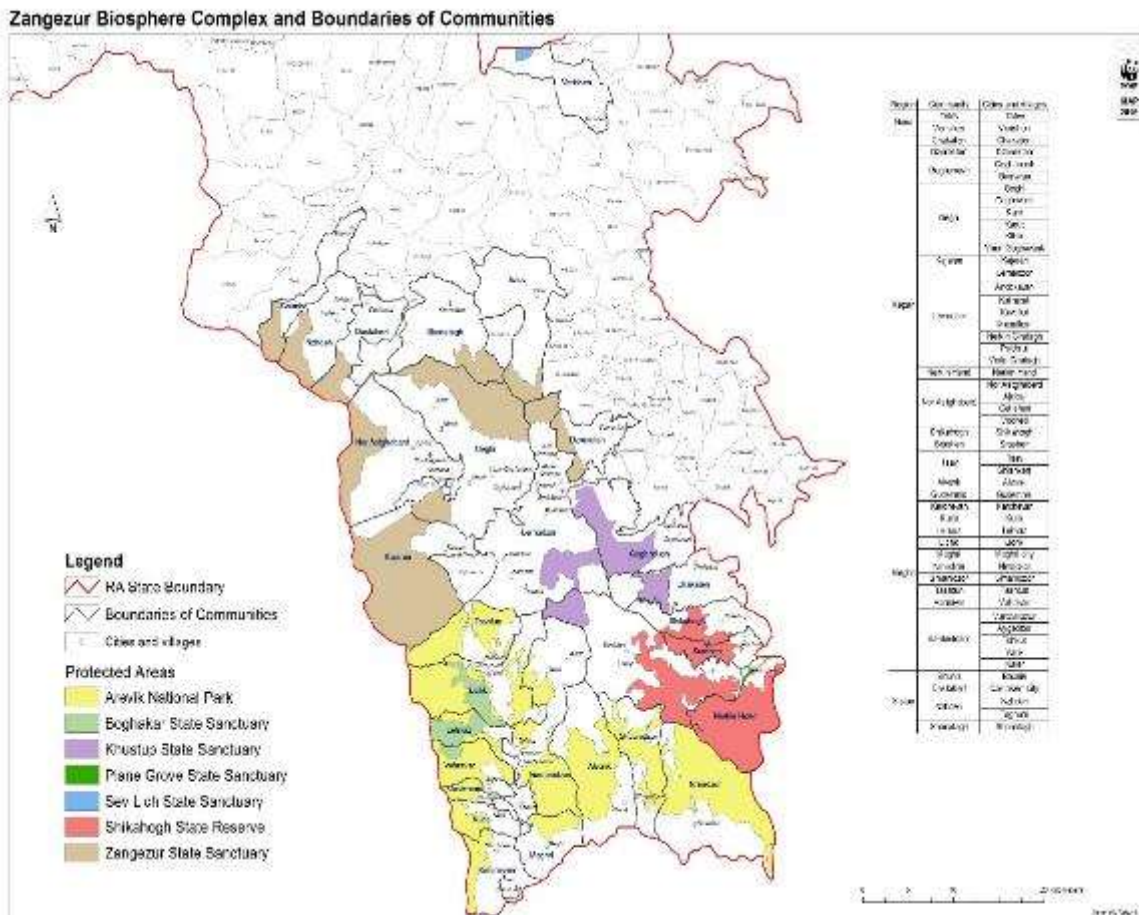


Figure 27: Map of Zangezur Biosphere Complex



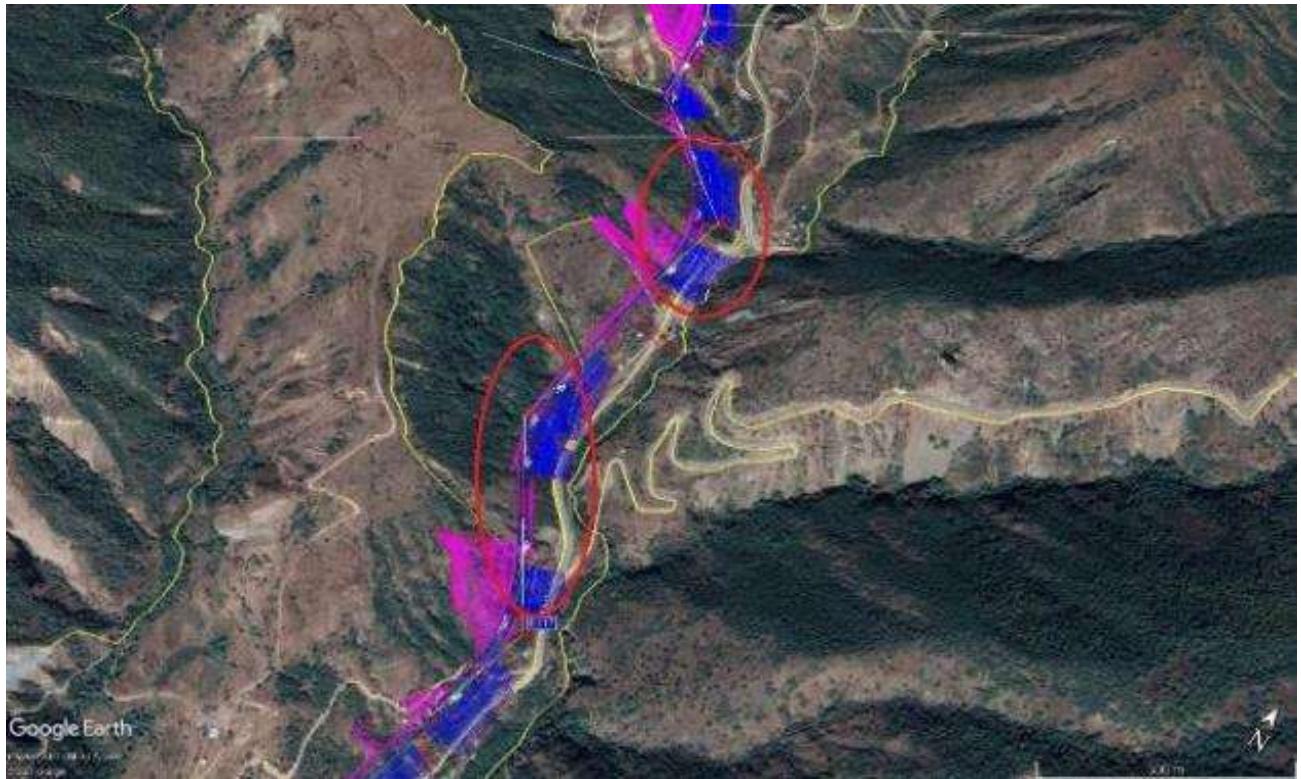
Some sections of the new road touch the area of the Zangezur Biosphere Complex (Arevik National Park). Prior to the preparation of the EIA report, negotiations were held with the official representatives of the Zangezur Biosphere Reserve. A group of specialists conducting field research - zoologists, botanists, archeologists and the representatives of the biosphere reserve together visited all the places where the planned road crosses the borders of "Arevik" National Park. During the visits, research was conducted and the risks were identified. Crossings with the planned highway, as well as the relevant maps are presented below.

- Part 1 - widening of the current M2 road from the planned tunnel exit to about 2.5 km





- Part 2 - Vank-Kaler intersection, about 1.2 km





- Other parts (3 sections) - about 100-250 m



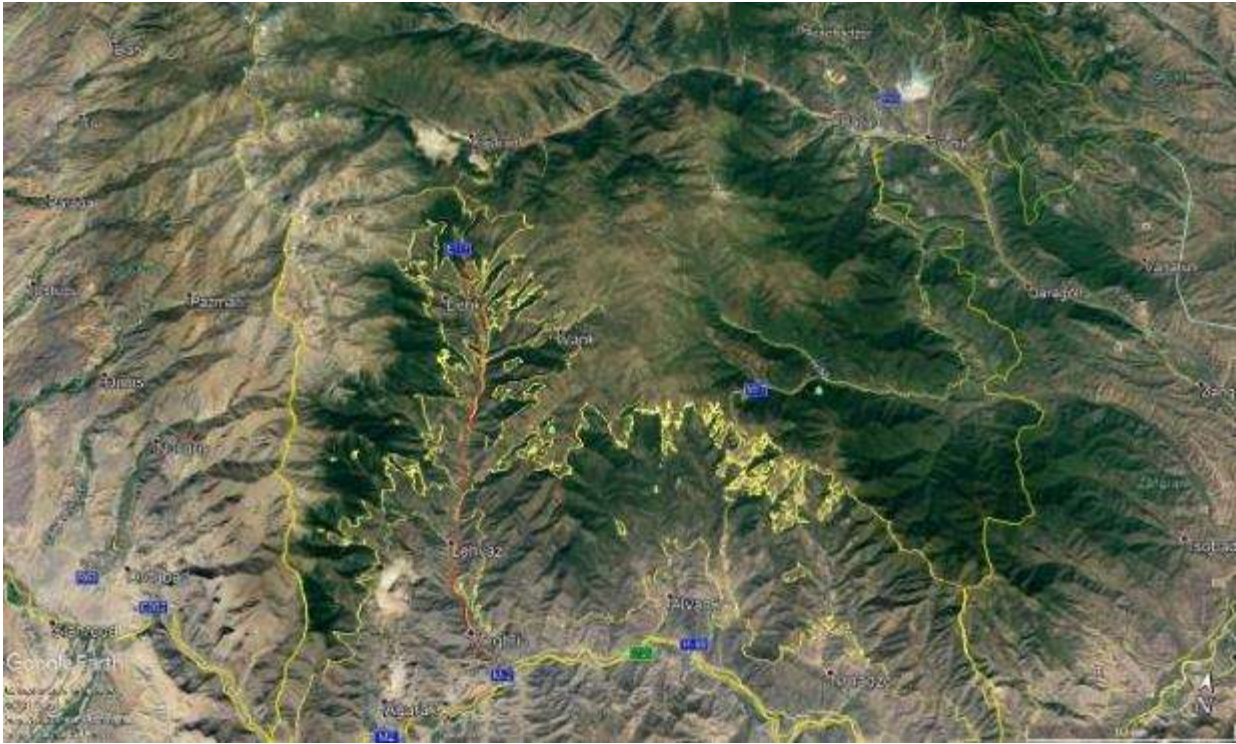


Figure 28: Crossing of the road plan with Zangezur Biosphere Reserve

Specialists have carried out detailed studies to identify possible negative impacts on the Zangezur Biosphere Reserve, as well as to identify the risks. During the research, the specialists were accompanied by the representative of the biosphere reserve, Harutyun Yeghishei Martirosyan, who holds the position of inspector of "Boghakar" precinct in "Arevik" National Park. The research did not reveal any serious risks, and the general measures to mitigate the impact on specially protected areas are presented in the EMP.

Field survey images are presented in Appendix 13.

4.2.5 Historical, cultural and natural monuments

There are many natural monuments in Syunik region. The list of natural monuments of the Republic of Armenia was adopted by the decision of the Government of August 14, 2008 N 967. The natural monuments in Syunik region are presented below:

Geological monuments

- **«Satana» natural sculpture** - near the Goris,
- **«Ananun» rock remains** - Near the Goris,
- **«Ananun» small forms of relief** - On the north-eastern edge of the Sisian,



- **«Ananun» small forms of relief** - North-east of Kajaran mineral water spring, on the left bank of Voghji river,
- **«Malevi itrusia» intrusive** - Meghri sub-area, about 1-1.5 km north of Alvank village, near the abandoned Mal village,
- **«Ananun» rock exposures** - On the left and right sides of 180-181 km of Yerevan-Sisian highway,
- **«Khoradzor» V-shaped gorge** - 1.5-2.0 km north-east of Khnatsakh village,
- **«Ananun» erosion relief** - 2.5 km north-east of Khnatsakh village, on the left side of the road leading to Berdzor,
- **«Ananun» columnar basalts** - 2 km from Halidzor village, in Vorotan gorge,
- **«Ananun» aplite nurses** - 30-35 km south of Kapan,
- **«Hert» mural** - 3 km north-east of Sisian, near "Shaki" waterfall,
- **«Pxi tshter» mural** - About 25 km south from Kapan, on the road leading to "Shikahogh" state reserve,
- **«Ananun» columnar basalts** - On the south-western edge of Vorotan village,
- **«Shishkar» (Baxakhar) nurse** - On the right and left sides of the Baghakar river,
- **«Ananun» pyramidal remnants** - 2 km north of Verishen village, on the left side of Goris-Khoznavar road,
- **«Satani kamurj» natural bridge** - Syunik region, 2.5 km north-east of Tat village,
- **«Bnakan tunnel»** - Near Karahunj village, on Goris-Kapan highway,
- **Fossil flora of «Agarak»** - Agarak,
- **Fossil flora and fauna of «Shambi»** - 500 m north-east of Shamb village, on the left bank of Vorotan river, at an altitude of 1300 m.

Hydrogeological monuments

- **«Tsortsor» sources** - 4 km away from Angeghakot village, on the right bank of Tsortsor river, at an altitude of 1650 m above sea level,
- **«Vardanidzor» sources** - 17 km south-east of Angeghakot village, 160 m below Sisian-Nakhichevan highway
- **«Smbul» source** - In the north-eastern part of Angeghakot village, at an altitude of 1740 m above sea level,
- **«Anapat» source** - In the southern suburbs of Angeghakot village, at an altitude of 1840 m above sea level,
- **«Djrakhatsi» source** - 0.5 km north-east of Bardzrahan village, at an altitude of 1350 m above sea level,
- **«Sevdjur» source** - On the north outskirts of Geghi village, on the left bank of Geghi river, between the mill and bridge, at an altitude of 1600 m above sea level,
- **«Shahbulakh» source** - On the northern outskirts of Davit Bek village, on the right bank of the Kashuni River gorge, between the mill and bridge, at an altitude of 1065 m above sea level,



- «**Khiahriz**» source - 1.5 km north-east of Nrnadzor village, at an altitude of 670 m above sea level,
- «**Ananun**» source - On the north-eastern outskirts of Shaki village, at an altitude of 1685 m above sea level,
- «**Mets Novi**» source - 0.5 km north-east of Shinuhayr village, on the roadside, near the khachkar,
- «**Vorotan**» source - On the north outskirts of Vorotan village,
- «**katnaxbyur**» source - On the outskirts of Tandzaver village, on the edge of the forest, on the right bank of Kashuni river, at an altitude of 1570 m above sea level,
- «**Spitakdjur**» source - 1.4 km from Tandzatap village, on the left bank of an anonymous river, at an altitude of 1480 m above sea level,
- «**Shran**» source - 1.2 km south of Kashuni village, at an altitude of 1930 m above sea level,
- «**Ananun**» source - In the northern part of Karahunj village, on the right side of the landslide body, at an altitude of 1250 m above sea level.

Hydrological monuments

- «**Tsahkar**» lake - In the upper part of Zangezur mountain range, at the top of Tsaghkar river, about 10 km south-west of Kajaran city, at an altitude of 3271.5 m above sea level,
- «**Kaputan**» (**Gogi**) lake - At the source of the Kajaran river, about 5-6 km from the town of Kajaran, at an altitude of 3202 m above sea level,
- «**Antak**» lake - 1 km north-east of Zardov reservoir of Brnakot village,
- «**Gazana**» lake - In the sources of Geghi village, about 9 km north-east of Geghi village, at an altitude of 3111.8 m above sea level,
- «**Kapuyt**» lake - At the source of Meghri river, about 8 km north-east of Lichk village,
- «**Berdalich**» lake - 13 km north-east of Tsghuk village, at an altitude of 3005, 7 m above sea level,
- «**Kaputdjukh**» waterfalls - 3.0 km west of Kajaran town, on Kaputjugh river,
- «**Shinuhayr**» waterfall - On the left side of Vorotan river, 0.5 km north-east of Old Shinuhayr,
- «**Akhvan**» waterfall - 2.0 km from the abandoned Mal village, left tributary of Meghri river, Mal river,
- «**Vardanidzor**» waterfall - 2.5 km north-east of Vardanidzor village, on the Vardanidzor tributary of Berdakar river,
- «**Ajibaj**» waterfall - On the left tributary of the Geghi river, Ajibaj, 4 km north-east of the village of the same name,
- «**Shaki**» waterfall - On the left tributary Shaki of the Vorotan River,
- «**Parvadzor**» waterfall - On the left tributary of Berdakar river, 3 km north-east of Vardanidzor village.

Historical natural monuments

- **St. Vardan Church cave dwelling and spring complex** - 0.5 km from Angeghakot village, to the right of Angeghakot-Shaghat road,



- **Natural caves of Artsvanik village** - 3 km from Artsvanik village, near Yeritsavank,
- **«Vorotan» natural historical complex** - On the south-western edge of Vorotan village on the right and left banks,
- **Volcanic rocks of Old Goris ("Kyores")** - In the eastern part of Goris, on the left bank of the Vararak river.

Biological monuments

- **«Meghri sosi»** - Meghri,
- **«Shiblyak»** - Kapan, in Arajadzor precinct, at an altitude of 800-900 m,
- **«Sfagnumayin mamurner»** - 5-6 km north of Gorayk village, near Vorotan mountain pass.

The detailed research revealed that none of the mentioned natural monuments will be affected during the implementation of the Project, as they are not located in the Project impact area.

There are many historical and cultural monuments in Syunik region. The list of historical and cultural monuments of the Republic of Armenia was adopted by the decision of the Government of March 15, 2007 N-385-U. Based on the mentioned Government Decision list of the Natural Monuments prepared and presented below in Table 9 that shows the Natural Monuments located in the areas close to the Kajaran-Agarak road. During the preparation of the EIA report, all the natural monumets, which potentially could be impacted by the project have been studied in detail and are now presented in Annex 9 of the EIA report, as well as appropriate safeguards were designed and provided for their protection.

Table 9: Historical and cultural monuments located in the areas near to Kajaran-Agarak road section, which can be impacted

Site type	Unit number	X	Y	Z	Community	Code in the state list
Necropolis	001	604397,66	4335594,95	1529	Lernadzor	8.38.8.
Archaeological complex	002	604171,22	4335110,31	1514	Lernadzor	8.38.1.
Old Lernadzor village remains	003	604113,11	4334917,95	1551	Lernadzor	8.38.5., 8.38.5.1. and 8.35.5.2.
Structures	004	601769,87	4326458,69	1884	Tashtun	Newly discovered
Bridge	005	602808,45	4325072,04	1750	Tashtun	8.100.5.
Bridge 1	006	603616,38	4323770,55	1649	Lichk	Newly discovered
Bridge 2	007	604597,95	4318702,85	1285	Lichk	Newly discovered
Bridge	008	604603,17	4318230,09	1260	Vardanidzor	Newly discovered
Khachkar-1	009	604485,94	4315820,37	1140	Vardanidzor	Newly discovered
Structures 1	010	604569,79	4315673,27	1132	Vardanidzor	Newly discovered
Pushkag Medieval village remains	011	604611,74	4315420,33	1120	Vardanidzor	8.92.4. and 8.92.4.1.
Khachkar-2	012	605234,24	4314652,99	1074	Vardanidzor	Newly discovered
Horticultural landscape	013	605276,78	4314555,52	1092	Vardanidzor	Newly discovered
Structures 2	014	605213,6	4313536,53	1036	Vardanidzor	Newly discovered
Structures 3	015	605135,88	4313088,28	1021	Vardanidzor	Newly discovered
Cemetery	016	605605,46	4311065,89	909	Lehvaz	8.37.1.
Water Mill	017	605620,85	4310640,61	860	Lehvaz	8.37.5.
Horticultural landscape	018	605833,98	4308546,52	794	Gudemnis.	Newly discovered
Meghri Pokr Tagh complex	019	607726,95	4305976,82	670	Meghri	8.5.2.1.-8.5.2.20.



As a result of the fieldwork, 19 monuments were documented along the entire length of the project, 14 of which are in the area of direct impact of the project (Appendix 9, Table 42). In general, the proposed 42,300 m long Kajaran-Agarak road (Tranche 4, Precinct 1 and Precinct 2) will pass through nine (9) settlements, which are: Lernadzor, Kajaran, Tashtun, Lichk, Lehvaz, Vardanidzor, Gudemnis, Meghri and Karchevan, from which only 6.95 km must pass through a tunnel, from Pk 3.5 to Pk 10.45 within the borders of Lernadzor, Kajaran and Tashtun communities.

4.3 SOCIAL AND CULTURAL RESOURCES

The proposed project area is located in southern part of the country in the Syunik region.

Syunik region

Territory – 4506km²;

Communities, as of the beginning of 2019 - 8

Towns - Kapan (Regional center), Goris, Sisian, Kajaran, Meghri, Agarak, Dastakert;

Villages - 131;

Population number as of the beginning of 2019 - 137.6 ths. person;

Of which: urban – 93.4 ths. person; **rural** – 44.2 ths. person.



Figure 29: Map of Syunik region

Syunik region of the Republic of Armenia is situated in the south of the Republic of Armenia. In the North the region borders with Vayots Dzor region, in the South it borders with Iran, (the length of border is 42 km), in the West - Nakhijevan and in the East - Artsakh.

Syunik region of the Republic of Armenia lays on the Zangezur nature area, which includes the basin of upper and average flows of the Vorotan, Voghchi rivers and the eastern slopes of the Zangezur, which is the highest after the South Caucasus in the Caucasus mountain range. The highest mountain of the region is the Kaputjugh (3 906 m), and the lowest place is the canyon of Meghri (Araks valley 380 m).

Syunik region occupying strategic and geographic-political important position, having rich resources of natural raw materials, industrial big capacity and being one of the biggest administrative and economic regions of the



republic, at the same time is remained as a one of not enough inhabited and economically developed regions, which is connected with a big distance from the capital and lack of alternative modes of transport communication.

It is the richest marz of the republic with useful minerals. The most important of them are non-ferrous metals (copper, molybdenum, zinc and others non-ferrous) and precious metals (gold, silver) and also non-metal useful minerals (construction and decorative stones, basalt raw materials, limestone and burnt shale marble and granite resources).

The most developed branches of economy are industry and agriculture.

In 2018 the share of economy main branches of the Republic of Armenia Syunik region in total volume of correspondent branches of the republic comprised:

- industry - 16.7 %,
- agriculture - 7.1 %,
- construction - 5.1 %,
- retail trade - 1.6 %,
- services - 2.5 %:

The main branches of region industry are mining industry and production of electric energy. The prevailing part of electrical energy produced in the marz belongs to Vorotan hydro-electric station cascade.

The agriculture of the marz is mainly specialized in plant growing (especially grains and potato growing) and livestock breeding (especially breeding of large and small cattle).

Freight and passenger transportations in the region are implemented by road, railway and electric transports (ropeway).

Armenia-Iran motor-road passes through the region, which has a great importance for the region economy development. In 2008 the “Kapan-Tsav-Meghri” motor-road of strategic importance was put into operation, which is alternative for “Kapan-Kajaran-Meghri” interstate road alternative and in technical indicators it surpassed the last one.

The major motor-road which connects RA to Artsakh and the only direct connection way between RA and The Republic of Islamic Iran are passing through the region.

Regional center - Kapan town (as of the beginning of 2019 comprised 42.3 ths. person) is situated at the foot of Khustup mountain (3 201 m), is situated in 301 km distance from Yerevan. The main branches of economy are industry and construction. The leading trend of industry is mining industry, especially non-ferrous and noble metals production. The manufacturing industry (production of food, textile products, non-metallic mineral products, aluminium and metal-plastic products, wood and wood products, furniture and equipment) and electricity production have also the significant share.

The road section envisaged by this program will pass through the territory of 2 enlarged communities (Kajaran և Meghri), in which the following villages and towns will be the main affected (Table 15) .



Table 10: Affected communities

Communities	Villages / Cities
Kajaran	Lernadzor village
	Kajaran city
Meghri	Tashtun village
	Lichk village
	Vardanidzor village
	Vahravar village
	Gudemnis village
	Lehvaz village
	Kuris village
	Karchevan village
	Meghri city
	Agarak city

Community - Kajaran

Height above sea level - maximum - 3904 m (Kaputjugh l.), minimum - 1200 m

Area - 57927 ha

Population - 8296

The enlarged community of Kajaran was formed in 2017 by merging the urban communities of Kajaran and Kajarants, Lernadzor, Geghi, Nor Astghaberd. The center of the community is the town of Kajaran. The community includes 21 communities. Kajaran urban community and Kajarants, Lernadzor, Pukhrut, Katnarat, Dzagikavan, Babikavan, Andokavan, Hovshut, Geghavank, Geghi, Getishen, Nor Astghaberd, Ocheti, Ajebaj, Kard, Nerkin Giratagh, Verin Giratagh, Kits. Evidence of Kajaran community from time immemorial is evidenced by the pagan chapel preserved on Mount Gandzasar until the 1950s, the pits found in the city, traces of foundries, and ore deposits. They prove that copper was mined in Kajaran in the Bronze Age. The city was part of the historic Dzorq province of Syunik province.

Kajaran multi-residential community was formed in accordance with the Law of the Republic of Armenia "On Making Amendments and Addenda to the Law of the Republic of Armenia" On Administrative-Territorial Division of the Republic of Armenia "HO-93-N of June 9, 2017, as a result of unification of 5 communities in Kapan region. It includes 21 communities, one of which is the city of Kajaran. All other communities are rural. According to << Part 3 of Article 102 of the RA Law on Local Self-Government >>, the local self-government bodies of the community have assumed their powers since November 13, 2017.

Village - Lernadzor

Population – 344;

Distance from the regional center - 21 km;

Height above sea level - 1600 m;



Status: border village, high mountainous.

Area - 102,87 km²

According to the legend, a part of the ancestors of the inhabitants immigrated from the villages of Karadagh region of Persian Armenia. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 15808 ha, including:

Agricultural lands - 9184 ha, of which: - arable land – 66 ha, grassland - 294 ha, pasture - 3294 ha, other land - 5530 ha;

Residential lands - 208 ha;

Lands of industry, entrails use and other production purposes - 139 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 42 ha;

Lands of special protected areas - 498 ha;

Forest lands - 5578 ha, of which forest cover - 4042 ha;

Water lands - 160 ha.

City - Kajaran

Population - 6916

Geographical location, climatic conditions

The city of Kajaran was founded on August 21, 1958. It is located in the Syunik region of the Republic of Armenia, on the banks of the Voghji River, on the eastern branches of the Zangezur mountain range, 25 km southwest of the regional center, 345 km from Yerevan, 50 km from the Islamic Republic of Iran. Altitude - 1750-1800 m above sea level. The town is bordered by Kajarants to the west and Lernadzor to the east. The terrain is a complex mountain, strongly cut by numerous tributaries of the Voghji River. The main factors that create relief: erosion, wind, landslides / human economic activity. The average annual air temperature is +6, the relative humidity is 65-85%, the precipitation is 450-500 mm, the average wind speed is 4.5-5.5 m / s, and rarely reaches 20 m / s. The main directions are north-western and western.

Economy

The main branch of the economy is the mining industry. Zangezur Copper and Molybdenum Combine CJSC is one of the largest industrial enterprises in Armenia, operates in the city. There are also other enterprises: "Kajaran Communal Economy" OJSC, which carries out the household garbage collection of the city, "Kajaran Community Communal Economy" CJSC, which cares the city's water sanitation works, "Kajaran branch of" Armenia Networks "CJSC. The city is also supplied with gas, as a result of which the city is thoroughly gasified; the city has medical facilities: Kajaran Medical Center, Kajaran Polyclinic.

Education, culture, sports

There are 2 secondary schools in the community, which have been thoroughly renovated, provided with local heating system, 2 pre-school institutions, one of which is under the jurisdiction of the community, and the other of "ZCMK" CJSC; There are also "Kajaran Vocational School" SNCO, "Kajaran Children's Art School" SNCO, as well as "Kajaran MPMD". The cultural programs of the city are implemented by the cultural sphere of Kajaran



community; it is held in Kajaran Culture Palace; There is an environmental organization "Kenny" in the city, which implements environmental programs, within the framework of which it constantly supports the upgrading and medical care of Kajaran Medical Center, the "Kajaran" Foundation, whose financial means are formed from the voluntary allocations of the residents.

Soil and other natural resources

Land (total) - 1996 ha, including:

Agricultural lands - 970 ha, of which: - grassland - 9 ha, pasture - 588 ha, other land - 351 ha;

Residential lands - 105 ha;

Lands of industry, entrails use and other production purposes - 779 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 2 ha;

Lands of special protected areas - 7 ha;

Forest lands - 124 ha, of which forest cover - 122 ha;

Water lands - 8 ha.

Communitie - Meghri

Population - 11724

Meghri multi-residential community was formed in September 2016 as a result of enlargement of all 13 communities of Meghri region of Syunik marz of the Republic of Armenia by the RA law HO-100-N of June 17, 2016 "On Making Amendments to the Law of the Republic of Armenia" On Administrative Territorial Division of the Republic of Armenia ". It includes the urban communities of Meghri and Agarak, as well as Alvank, Aygedzor, Gudemnis, Tkhkut, Lehvaz, Lichk, Karchjan, Kuris, Nrnadzor, Shvanidzor, Vahravar, Vardanidzor and Tashtun rural communities. Registered population by communities - Meghri: 4601, Agarak: 4729, Karchan: 270, Shvanidzor: 339, Vahravar: 35, Goodemnis: 36, Lichk: 147, Tashtun: 116, Lehvaz: 627, Alvank: 289, Vardanidzor: 152, Nrnadzor: 151, Tkhkut: 67, Kuris - 53, Aygedzor - 2.

Meghri region is located in the south of Zangezur, at an altitude of 390 m (Meghri gorge) to 3904 m (Kaputjugh). It has a mountainous cut surface. In the north-northeast is the Meghri mountain range, in the west - the Zangezur mountain range. Meghri gorge occupies a significant part of the area. There are gold, polymetallic, copper, molybdenum, nepheline syenite, and iron and limestone deposits. They dominate the forest and alpine meadow landscapes.

The climate is dry subtropical, cold mountainous in the highlands. The average temperature in January is from 1 ° C to -12 ° C, in July - 8-26 ° C, the annual precipitation is 250-700 mm, the vegetation period is 40-230 days. The largest river is the Araks flowing through the state border. Meghri, Tashtun, Karchjan, Malev and other rivers flow through the area. The Karchevan canal is functioning.

Village - Tashtun

Distance from the regional center - 60 km,

Distance from Meghri city - 26 km,



Height above sea level - 1950 m,
Status: border, high mountainous.

Area - 21,60 km²

Density - 6,2 man/km²

Soil and other natural resources

Land (total) - 5026 ha, including:

Agricultural lands - 1373 ha, of which: arable land - 78 ha, perennial planting - 4 ha, grassland - 52 ha, pasture - 502 ha, other land - 737 ha;

Residential lands - 29 ha;

Lands of industry, entrails use and other production purposes - 1 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 27 ha;

Lands of special protected areas - 3485 ha;

Forest lands - 97 ha, of which forest cover - 3 ha;

Water lands - 12 ha.

Village - Lichk

Distance from the regional center 0 59 km,

Distance from Meghri city - 24 km,

Height above sea level - 1780 m,

Status: border, mountainous.

Area - 34,92 km²

Density - 4,5 man/km²

It was also called Leshkin, Lechkin, Lich, Lichk, Sheshkert. There are several lakes above the village, for which, according to the locals, the village was named Lichk. The village was built in 1781. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 8411 ha, including:

Agricultural lands - 2404 hectares, of which: arable land - 266 ha, grassland - 19 ha, pasture - 1004 ha, other land types - 1116 ha;

Residential lands - 74 ha;

Lands of industry, entrails use and other production purposes - 7 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 26 ha;

Lands of special protected areas - 5563 ha;

Special purpose lands - 1 ha;

Forest lands - 309 ha, of which forest cover - 78 ha;

Water lands - 28 ha.

Village - Vardanidzor

Distance from the regional center - 67 km,



Distance from Meghri city - 11 km,
Height above sea level - 1050 m,
Status: border.
Area - 23,02 km²
Density - 13 man/km²

It is located on the left bank of the Meghri River. The main directions of agricultural activity are cattle breeding and field work. 103 farms are engaged in agriculture.

Soil and other natural resources

Land (total) - 9312 ha, including:

Agricultural lands - 5176 ha, of which: arable land - 125 ha, perennial planting - 4 ha, grassland - 12 ha, pasture - 1468 ha, other land - 3567 ha;

Residential lands - 54 ha;

Lands of industry, entrails use and other production purposes - 20 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 16 ha;

Lands of special protected areas - 4002 ha;

Forest lands - 36 ha, of which forest cover - 1 ha;

Water lands - 7 ha.

Village - Vahravar

Distance from the regional center - 78 km,
Distance from Meghri city - 11.5 km,
Height above sea level - 1380 m,
Status: border.
Area - 8,02 km²
Density - 5,9 man/km²

Vahravar is one of the ancient communities of Armenia. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 3249 ha, including:

Agricultural lands - 626 ha, of which: arable land - 26 ha, perennial planting - 13 ha, pasture - 169 ha, other land - 418 ha;

Residential lands - 16 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 16 ha;

Lands of special protected areas - 2590 ha;

Water lands - 1 ha.

Village - Gudemnis

Distance from the regional center - 82 km,
Distance from Meghri city - 16 km,



Height above sea level - 1400 m,

Status: border.

Area - 15,58 km²

Density - 2,5 man/km²

The former names are Gidemnas, Gitemnas, Gtanis, Kademnis, Uchanapar, Ujanabas, Ujanapar. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 1407 ha, including:

Agricultural lands - 578 ha, of which arable land - 43 ha, perennial planting - 9 ha, pasture - 37 ha, other land - 489 ha;

Residential lands - 17 ha;

Lands of industry, entrails use and other production purposes - 1 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 5 ha;

Lands of special protected areas - 804 ha;

Water lands - 2 ha.

Village - Lehvaz

Distance from the regional center - 73 km,

Distance from Meghri city - 6 km,

Height above sea level - 900 m,

Status: border.

Area - 16,87 km²

Density - 16,87 man/km²

The former names are Legba, Legvaz, Lekvaz, Lehvana, Levaz, Levaz, Levagodzor, Lihkvaz, Lehvaz internal. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 3385 ha, including:

Agricultural lands - 1336 ha, of which - arable land - 77 ha, perennial planting - 39 ha, grass - 12 ha, pasture - 332 ha, other land - 876 ha;

Residential lands - 57 ha;

Lands of industry, entrails use and other production purposes - 4 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 17 ha;

Lands of special protected areas - 1934 ha;

Forest lands - 22 ha, of which forest cover - 22 ha;

Water lands - 14 ha.

Village - Kuris

Distance from the regional center - 85 km,

Distance from Meghri city - 15 km,



Height above sea level - 1365 m,

Status: border.

Area - 14,31 km²

It is located on the right bank of the Meghri River, on the slope of the Zangezur mountain range. The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) – 2013 ha, including:

Agricultural lands - 664 ha, of which - arable land - 39 ha, perennial planting - 2 ha, pasture - 28 ha, other land - 596 ha;

Residential lands - 20 ha;

Lands of industry, entrails use and other production purposes - 275 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 6 ha;

Lands of special protected areas - 1023 ha;

Forest lands - 24 ha, of which forest cover - 24 ha;

Water lands - 1 ha.

Village - Karchevan

Distance from the regional center - 95 km,

Distance from Meghri city - 17 km,

Height above sea level - 920 m,

Status: border.

Area - 29,04 km²

Density - 10 man/km²

The main directions of agricultural activity are cattle breeding and field work.

Soil and other natural resources

Land (total) - 4180 ha, including:

Agricultural lands - 2446 ha, of which: arable land - 60 ha, perennial planting - 3 ha, pasture - 90 ha, other land - 2293 ha;

Residential lands - 39 ha;

Lands of industry, entrails use and other production purposes - 279 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 50 ha;

Lands of special protected areas - 1249 ha;

Special purpose lands - 15 ha;

Forest lands - 54 ha, of which forest cover - 54 ha;

Water lands - 46 ha.

City - Meghri

Distance from Yerevan city - 376 km,

Distance from the regional center - 84 km,



Height above sea level - 610 m:

Meghri is located in the south-eastern part of the Republic of Armenia. It is one of the southern border towns of Syunik region, which is spread on the right and left banks of the Meghri River, which are called Big and Small Districts. The city is separated from the Islamic Republic of Iran by the state border, the mother Araks River. The climate of the city is dry-subtropical. This is where the spring of Armenia begins, and autumn says goodbye at the latest. Summer is hot here, and winter is not snowy.

Economy

The man from Meghri was a tribal fruit grower and gardener. Aromatic and fresh fruits grow here. In recent years, subtropical crops such as coriander, kiwi, olive, etc. have been added to figs, pomegranates, quinces, grapes, and peaches. At present, there are canneries in the city. Only "Meghri Chanshin Enterprise" LLC works from construction companies. The city, which looks like an ancient amphitheater, is given a special charm by the 11th century structure perched on the mountain tops: the 6 fortresses of Meghri (burgers), the park of centuries-old plane trees and 17th century structures S. Mariam Astvatsatsin, S. Hovhannes, Sargis churches and Anapastanats monastery. The frescoes of the church belong to Naghash Hovnatan school. Meghri communicates with the capital Yerevan, the regions of Armenia only by road. The Iran-Armenia interstate highway passes through the city. Since December 2008, Meghri has been cooperating with the city of Myadel in the Republic of Belarus through friendly, economic and cultural ties.

Soil and other natural resources

Land (total) - 3201 ha, including:

Agricultural lands - 1856 ha, of which: arable land - 77 ha, perennial planting - 78 ha, grassland - 2 ha, other land - 1699 ha;

Residential lands - 223 ha;

Lands of industry, entrails use and other production purposes - 105 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 18 ha;

Lands of special protected areas - 906 ha;

Special purpose lands - 76 ha;

Water lands - 18 ha.

City - Agarak

Distance from the regional center - 94 km,

Distance from Yerevan city - 410 km,

Height above sea level - 660 m:

The town of Agarak was founded on the left bank of the Araks River in 1949 as a township adjacent to the Copper and Molybdenum Combine of the same name. The construction continued until 1992. At first, 1-2-storey private houses were built, later 3-4, and since 1979, 5-storey residential buildings. In 1996, township was renamed Agarak city. The city of Agarak has all the structures that provide vital, cultural, sports, educational and general development: a hospital, a communal improvement economy, a nursery-kindergarten, a secondary school, an art and library service centre, a palace of culture. "Agarak N1 / Kindergarten" is a wonderful kindergarten consisting of two buildings, in which 200 children are educated in a beautiful, renovated atmosphere in



accordance with modern conditions. "Agarak Secondary School" SNCO is a renovated school consisting of two buildings, in which about 200 students' study and receive secondary education. "Agarak Extracurricular Education-Library Service Centre" NGO, in which 147 children are brought up, taking lessons in dance, painting, song, music and culture, has recently been carrying out its work activity with new vigour and energy. The town of Agarak is located in the south-eastern part of the Republic of Armenia, borders the Islamic Republic of Iran, is of strategic importance, and is located 1 km from the highway connecting Armenia with Iran. The town is provided with medium-sized private hotels, the doors of which are always open to any guest. The town of Agarak has a very regular street network. The streets are of 2 types: community-intra-district, respectively 10 m and 6 m wide. The only functioning way to ensure the engineering and transport communication of the city is the highway. The town has large resources of natural resources, the most common of which is copper-molybdenum raw material. The predominant branches of production are the mining industry and agriculture. The economic and labor market of the city has been conditioned since the day of the creation of the city, and it still exists today with the activity of "Agarak PM Combine" CJSC. Referring to the land fund of Agarak community, it should be noted that most of the lands are residential, public, communal-storage areas. Agarak, as the southern gate of the Republic of Armenia, a small border town, has great prospects for the development of territorial, population, cultural, economic, transport and other spheres in the near future.

Soil and other natural resources

Land (total) - 326 ha, including:

Agricultural lands - 34 ha, of which arable land - 22 ha, other types of land - 12 ha;

Residential lands - 236 ha;

Lands of industry, entrails use and other production purposes - 33 ha;

Lands for energy, transport, communication and communal infrastructure facilities - 6 ha;

Lands of special protected areas - 4 ha;

Special purpose lands - 7 ha;

Water lands - 7 ha.

4.4 MAIN ECONOMIC ACTIVITY

Mining, agriculture, and trade are the three main economic sectors that provide jobs for people.

Agriculture

Agriculture, mainly fruit growing and mixed animal husbandry, is the main economic activity of rural areas. Meghri is a shopping center: light industry (food development) and trade, including cross-border trade with Iran, are developed here:

Mining

From 1949 Syunik region is important for metalworking:



The Agarak copper and molybdenum mine and the Zangezur copper and molybdenum mine are major employers in the Program area.

Zangezur copper and molybdenum combine located in the valley of Voghji. The existing field operates within 1,920-2,360 m, and the Kajaran processing combine is located at an altitude of 1,750 m above sea level.

Hydro energy

Meghri district has a large reserve of potential hydroelectric power due to its steep topography and water resources. The river's hydroelectric power has no consumer water use, but diverts water from its natural line. There are already three small hydroelectric facilities on the river that use the water of the Meghri river. It is planned to build one large international hydroelectric power station on the Araks river (on the border with Iran).

4.5 ARCHAEOLOGICAL RESOURCES

The route or contour of the road was set on the basis of GIS with the raster accuracy of 10 m on the maps (ArcGIS 10.4), following which the archaeological, historical-cultural and other monuments subjected to the impact, as documented by the team, have been inserted along the studied areas in the form of historical units. This provides an opportunity to target the units that are under immediate impact or those that remain directly under the road that is going to be built (DUB), as well as those that are not under immediate impact, however, can be at the risk of being destroyed or be partially impacted during the construction works. The collected information was compared to the state list in order to clarify the registered or newly discovered status of the monument. The surface earthen of the monuments, the obsidian objects and other items collected from their surface, which were cleaned and then evaluated, were used for dating the monuments. The distribution of the monuments is presented on GIS based maps (with separate pages, on scale 1:10 000) and with the color coding of the community spaces, their locations in relation to the community, and later also to the route, taking into consideration the road separations per km-picket. The documented units are presented according to their typological classification: burial ground, cemetery, chapel, church, castle, residence, bridge, etc. - units of archaeological, historical and historical-architectural and religious value (see the symbols). A total of 19 units (images 75 and 76) were documented along the entire route as a result of the indicated works, which are reflected on the units of a total of 46 maps (see images 75-76 and 121-122), as well as in a separate list (Table 42). More detailed information about the conducted studies and their results is presented it Annex 9.



5. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 DESCRIPTION

The Projects' positive and negative direct and indirect impacts to the physical, ecological, archaeological, cultural and socioeconomic resources, including the workers' and community health and safety in the Project's area of influence were identified. Corresponding mitigating measures were proposed based on significance and occurrence throughout the Project cycle from the design, preconstruction, construction to the operation and maintenance period.

The expected impacts of the project on the biophysical environment (such as soil erosion, increased noise and vibration levels, air and water quality) are likely to be temporary, occurring only during construction. These impacts are manageable; it will be possible to reduce or eliminate them altogether by implementing the mitigation measures proposed in the Environmental Management Plan in a timely manner. Environmental protection, public safety, safety of workers and employee hygiene at all stages of the project will be in full compliance with the legislation of the Republic of Armenia requirements, as well as of international funding and consulting organizations.

5.2 POSITIVE IMPACTS

The major trans-boundary impact is that the new road section will benefit transportation of goods and people. The Project is envisaged to bolster the economic growth of Armenia with its neighbouring countries such as Iran in the southern border and Georgia in the north.

The project will provide a link between remote communities of Kajaran and Meghri regions. The new road section will play a positive role in enhancing economic growth of those communities, region and the country.

The road will be designed and constructed to current high standards, facilitating driver safety (appropriate road markings, signage, safety, drainage, culverts, overpasses, underpasses and shoulders). The structural elements of the Project will be designed with consideration to the seismic activity of the region. Drainage will be incorporated into the road design to control flow, thereby minimizing erosion of soils and local flooding. The design will then enhance the sustainability of the project.

The scenic and healthy nature, water springs, forests, mountains, historical, cultural and natural monuments and sights located throughout the road section could become a fascinating tourism attraction site.

Temporary employment during construction works may provide additional income to the residences of local communities through the short-term local employment opportunities. Some may improve their situation temporarily while working on the Project. The minority population in the region is unlikely to be affected differently from the whole population, if at all.



5.3 NEGATIVE IMPACTS AND MITIGATION MEASURES DURING CONSTRUCTION PHASE

5.3.1 Impacts on Flora and Mitigation Measures

Prior to the preparation of the EIA report, field surveys were conducted to identify risks and develop appropriate measures.

The plan of the section of the road in question intersects with 10 ecological systems (A-J), 1920 m. above sea level up to 540 m above sea level will have direct and indirect effects on the physical and biological resources of the environment.

It is expected that the main reason for the destruction of Flora will be the construction of the tunnel and construction of an overpass road near it, particularly at the exit of the tunnel in the direction to the Meghri city, as that is included in the “Arevik National Park” area. There will be vegetation removal, which will lead to permanent loss of vegetation at the site. The total number of plant species along the proposed project was studied by a suitably qualified botanist to determine the types of affected flora based on a detailed design of the Kajaran-Agarak road section. The types of trees and shrubs, as well as their number found out during the study, are presented in the relevant sections of the report.

According to the Red Book for Flora (Governmental decree 29.01.2010, N 72-N), 55 Red Book listed species are known in the affected area, but not all of which will be directly affected. However, 17 plant species listed in the Red Book have been identified that may have a direct adverse effect on them, and measures to protect each of them are presented in this report.

The protected species in the project area shall have the special attention as provided in Armenia’s Law on Flora (1999) and the requirements of the Red Book for Flora. The Special mitigation measures have been included in the EMP to minimize the negative impact on flora and to avoid any detrimental effect to Red Book plants. Affected individuals shall be translocated, for which qualified botanist shall be hired. If it is not possible to transplant the plant (perennial trees, tall shrubs), it is necessary to collect seeds to get planting material in one of the local nurseries for further planting. More detailed information is provided in the EMP and Appendix 8.

There are several sections along the proposed plan where growing trees and shrubs will be cut down. According to the study, more than 19,000 (19,366) trees will be cut down during the construction works. More than 180,000 (185,659) bushes will be cut down after clearing and cutting the bushes. The loss of forest areas is estimated at more than 250,000 m². Detailed information about cutting trees and bushes is provided in Appendix 8.

The removed trees will be replanted where it is possible to do so. All the tree and shrub planting works should be organized either in late autumn, after defoliation, or in early spring. If all the trees are considerably old or



their replanting is not possible for other reasons, a part of them should be removed during the road construction. They should be replaced with new trees and shrubs with a relation of 2:1 (except species registered in the Red Book, the replacements of which should be planted with relation 10:1). The new trees should be taken care of for 3 years until they become viable (note: 80% survival is considered excellent). The use of local species is of great importance. The replanting areas are presented in Annex 8, however, additional areas can be selected by the Contractor and in that case those areas will also be approved by the Engineer.

The Contractor should prepare a special EMP for the replanting of trees, which should include the planting scheme, data about the species composition of the replanted trees and if necessary (in the case of selection of new areas), respective permissions from the state authorized body.

Trainings on nature protection and avoiding tree logging during construction works will be organized for the employees. The employees of the road construction will get warnings with special signs about the presence of plant species registered in the Red Book so that the nature is not imposed to additional damage. The Contractors will be responsible for supplying appropriate fuel to the construction camps in order to prevent tree loggings.

It is worth mentioning that the loss of trees from private properties (and loss of any other related entrepreneurship activity) is subject to compensation within the framework of Land alienation and resettlement procedures.

5.3.2 Impacts on Fauna and Mitigation Measures

Fauna such as birds, mammals, reptiles and amphibians are likely to occur at various habitats throughout the proposed road section.

Construction phase activities that will impact on animal life in the area include: (a) Increased human activity and associated noise. (b) Possible increase in hunting due to increased numbers of people in the area. (c) Increased traffic of trucks and heavy machinery and associated noise. (d) Increased noise levels due to construction activities. (e) Increased dust levels due to construction activities. (f) Stripping of vegetation and soil to clear and level areas for road construction. (g) Increased potential of soil erosion and contamination of soil, which will impact directly on vegetation and soil-dwelling organisms, and indirectly on other animals.

Mammals will move away from the noise and disturbance during the construction phase. Some mammals and reptiles will be vulnerable to illegal poaching and collecting during the construction phase due to the presence of personnel on construction area. Mammalian diversity at the proposed road section is not potentially high, there are 6 listed as Red Book species.

Based on the material collected during the research period for the project, the almost complete diversity of vertebrate animals found along the entire width of the planned route was identified, in close proximity to it, which may be influenced by anthropogenic factors related to earthworks.



From birds of prey, only *Accipiter brevipes* inhabits in the area which builds its nest on the high Junglans (walnut trees) growing on river banks and also in private orchards that can be affected during the construction of the envisaged route. Adverse effect on *Oriolus oriolus* is also possible which rarely nests here.

The adverse effect will mostly be posed on Common Redstart, *Sylvia curruca*, *Parus major*, and other representatives from the family of *Passeridae* which live on the right hillside of river Goz-goz, down the intersection of the village of Lichk, before the entrance and exit of the second tunnel - above the summer cottages, along the forested hillside. That may have an adverse effect on the population of *Perdix perdix* residing in the large meadows of this area. The trajectory of the old road repeats going down the road, which later turns to the right again and crosses the hillsides covered with rare *Juniperus* and tree-shrub layers, with rocky edges, where it will affect the habitats of *Cyanistes caeruleus*, *Sitta neumayer*, and *Serinus pusillus* to some extent. Moreover, the river crossing and bridge building works will have some adverse effect on water and offshore species, such as *Cinclus cinclus*, *Troglodytes troglodytes*, *Cettia cetti*, and a number of representatives of the family of *Motacilla*. During the construction of the railway which bypasses the town of Meghri, the habitats of *Laniidae*, *Onanthe xantoprymna*, *Sitta europaea*, and *Phasianidae* will be affected when the railway passes through rocky hillsides and semi-desert areas with sparse vegetation. In order to mitigate the adverse effect on the population of birds nesting in the area of the envisaged road it is advisable to carry out all the explosion and other soil works in late summer, or during autumn and winter, that is, not in the nesting season. This will help to avoid the adverse effects on nesting birds; they will be forced to move to new nesting locations from the start of the nesting season. It is also necessary to strictly maintain the borders envisaged for the new route and not to deviate from its trajectory. All this will give an opportunity to have a minimal effect on the existing avifauna.

Of the 27 mammal species, which were mentioned earlier, which may possibly reside on the trajectory of the planned route, visually and based on the traces of their vital activities, we have identified 21 species. *Neomys teres* and *Lutra lutra* may be posed to the adverse effect the most from the perspective of living in the highway construction areas since the habitats of these two species are directly connected with rivers Mulk and Meghri in the areas where the construction works will be in progress. As for the rest, taking into consideration the high activity of the animals, and that the area prepared for the route is not too large, they can be safely moved to safer habitats in the neighborhood of the construction area. Moreover, it should be noted that all the animal species indicated during the study already live near the road which is already actively used, which has not significantly affected their vital activity and behavior. We presume that upon completion of all the construction works and the mitigation of the growing man-made factor related to the construction, all the mentioned animals will continue using their habitats in the immediate neighborhood of the new route.

The most vulnerable group of vertebrates residing in the territory of the envisaged highway are the representatives of *Herpetofauna*. Running sedentary lifestyle and being connected to the local specialized habitats they will mostly hide in the shelters nearby.

Natrix natrix and *Rana macrocnemis* were noted prior to entering the large tunnel. Representatives of *Herpetofauna* were identified nearly from the large tunnel exit until the end of the envisaged road. *Elaphe*



hohenackeri species residing in the territory of the sparse forest is endangered, as well as are many lizards, such as *Lacerta strigata*, *Darevskia raddei*, that inhabit in the rocks and on open hillsides, areas with dense and sparse vegetation, and forests. The lower is the road the larger is the diversity of snakes and lizards. *Vipera raddri* species can be found near the highway intersection - the roads Vank and Arevik. The most endangered species are the representatives of Herpetofauna living on the dry rocky hillsides with sparse vegetation, starting from the point where the road starts turning around the town of Meghri, up to Agarak, since the most abundant species composition and the largest number of reptiles live in this section. We suggest having a specialist on herpetology joining the team during the construction along the project area, who will be responsible for hunting down snakes and lizards and moving them to new habitats appropriate for the species. Aside from that, it is advisable to conduct trainings for the employees prior to starting the construction works, especially for the drivers involved in the construction to be informed of the rules of behavior for encountering and identifying snakes. When encountering a snake, it is advised to stop the work and wait for the specialist who will catch the snake for the purpose of moving it to another location.

As prescribed by the RA law "On Fauna" (2000) and the requirements the Red Book of Animals (Decision of the Government N 71-N, dated 29.01.2020), a special attention needs to be paid to the species preserved in the area. Special mitigation measures were included in the EMP to bring the adverse effect on the fauna to the minimal and to avoid posing the species registered in the Red Book to adverse effect.

During the construction, the mammals, reptiles and amphibians gathering in large groups near the construction area, need to be collected and taken to more convenient and safer locations. The collection of animal species should be done prior to starting using heavy construction equipment. In the case of discovering inhabited nests, they need to be moved out under the supervision of a respective specialist prior to the start of the construction works.

Special attention needs to be drawn on the species presently preserved in the area, as prescribed by the RA law "On Fauna" (2000) and the requirements of the Red Book of RA Animals (Decision of the RA Government N71-N, dated January 29, 2010). The special mitigating measures were included in the EMP to bring the adverse effect on the fauna to the minimal and to avoid posing the species registered in the Red Book to adverse effect.

During field visits, possible destinations of migration routes have been investigated. As the studies have shown, there are no animal migration routes along the entire road. The installment of the envisaged water drainage system (water intake, rectangular pipes) will serve as a transition ensuring safe hunting, nesting, etc. of the animals.

The possible impact of the construction work camps includes poaching of edible animals and birds in the territory despite all the bans. The Contractor's specialist on environment and health will be responsible for providing the employees with the knowledge about fauna.



5.3.3 Impact on the Field of Industry (Mines) and mitigation measures

A number of mines are operating in Syunik province, of which two - “Zangezur Copper-Molybdenum Combine” CJSC and “Sipan-1” LLC are located quite close to the envisaged road. In order to identify and the possible risks and develop respective measures a contact was made with the official representatives of the mines. A response was received from the official representatives of the mines stating that they did not have any objection and/or suggestion in relation to the project implementation. The letters are presented in Annex 12.

Since the studies revealed that the construction of the envisaged road does not pose any risks for the mines and their operation, no special impact mitigation measures have been developed.

5.3.4 Impacts on Protected Areas and Mitigation Measures

Certain sections of the new road are attached to the territory of “Zangezur” Biosphere Complex (“Arevik” National Park). Prior to and during the preparation of the EIA report negotiations were held with the official representatives of “Zangezur Biosphere Complex SNCO. The group of specialists conducting field studies - zoologists, biologists, archaeologists, and representatives of the biosphere center visited all the locations together where the envisaged highway crosses the borders of “Arevik National Park”. During the visits, research was conducted and the risks were identified. The crossing with the envisaged highway, as well as the respective map are presented below:

- Part 1 – widening of the current M2 road with 2.5 km from the exit of the envisaged tunnel
- Part 2 – approximately 1.2 km in the territory of the intersection of Vank-Kaler
- Other sections (3-4 locations) – approximately 100-250

Detailed studies were conducted by specialists on possible adverse effects on “Zangezur” Biosphere Complex, as well as for the purpose of risk identification. A representative of the biosphere complex, Harutyun Yeghishe Martirosyan was escorting the specialists during the studies. No major risks were identified during the studies, and the general mitigation measures for specially protected natural areas are presented in the EMP.

Fragmentation of the habitats takes place when the road crosses the ecosystem. The sum of the created fragments may be less than the initial total value, even when the loss of the natural environment is minimal. Many animal species tend to follow set routs of daily and seasonal translocations. The road which crosses the reserve and blocks the in-and-out movements of wild animals may cause restriction in the dislocations of wild animals, since animals can hardly cross the road and the number of deaths caused by accidents will result in migration delays. The potential crossing zones of wildlife were defined during field studies, as well as through consultations with the specialists of “Zangezur” Biosphere Complex.

During the highway construction works all the vertebrates should be caught by specialists, placed in special containers and moved to other locations typical of the given species, away from human residential areas.



Prior to the start of the construction works, taking into consideration the studies conducted in specially protected and sensitive areas, a special monitoring and management should be done for the protected area, which should be developed by the Contractor and approved by the Engineer.

5.3.5 Impacts and Mitigation Measures Related to Water Resources

Contamination of water is possible during construction of 14 bridges in valleys, streams, and rivers as well as during construction of 3 tunnels. The potential impacts are associated with the following: accidental oil or grease spills, disposal of excavated earth, excess construction material left after construction works may be washed into the water sources and lead to sedimentation of water sources and lowering of the water quality, erosion of bare areas resulting from excavation and grading works and construction of drainage channels may increase runoff which will lead to sedimentation and increased turbidity in surface water as well as reduced groundwater infiltration, disposal of sewage, solid waste and construction material spills from construction camps located near valleys, streams and rivers. During construction of tunnels ground water may drip from the roof and the sidewalls of the tunnels due to the jointed and sheared rock masses, and jointed lime-stones and quartzites that can be found in areas of tunnels.

The following measures shall be taken into account to mitigate/restrict the impact on water quality:

- River beds and drainages in and around the construction site will be maintained in good condition and no excavation material or other particles originated by works will fall in them.
- Prohibit disposal of excavated spoils and debris into water bodies.
- Bridge construction activities including pile driving will be undertaken during summer and winter when water level is low in rivers or during dry periods for seasonal streams.
- Oil leaking equipment and machinery shall be forbidden to operate.
- All chemicals and oil will be stored away from water bodies.
- On construction site fuelling area of vehicles and equipment will be selected away from valleys, streams and rivers and should be protected by a berm to prevent runoff from leaving the area.
- Oil/ water separators to extract floating oils will be installed at the fuelling areas.
- Application of erosion control practices to prevent excessive onsite damage.
- Silt fencing and/or brush barrier will be installed for collecting sediments. Collected silt/sediment will be stockpiled for possible reuse.
- Training program shall be organized for all equipment operators, drivers, and warehouse personnel on immediate response for spill contamination and eventual clean-up.
- All wastes arising from the construction sites will be disposed in an environmentally accepted manner. Wastes will be collected, treated (e.g. sewage through septic tank) or stored (e.g. waste oil, lubricants, and paints) prior to disposal or transported to the approved disposal sites. No untreated sanitary wastewater will be discharged into the river.
- No vehicle or equipment will be washed, parked or refuelled near valleys, streams and rivers.



- All construction camps will be located at least 1km from rivers and to the extent possible labourers will be locally recruited to avoid large camps.
- Storm water collected on bridges will flow through an oil separator beneath the bridges to retain any pollutant from the road to run off directly into rivers,
- Adequate drainage structures will be provided to facilitate natural flow of water across road embankment.
- The Emergency Response Plan shall be prepared and approved involving action plan for hazardous spills treatment.

Special Mitigation measures for the tunnels will include:

- Installation of a water proofing system between the initial ground support system and the final concrete lining. This will consist of a PVC membrane with protection layers made from geo-textile material;
- Collection of roadway water in a dedicated drainage system to separate it out from the clean water drainage system. As the tunnel will be open for vehicular traffic, the drainage system will consist of a slotted gutter. This will be connected to the principal longitudinal drains by gully pits containing a siphon system.
- Water collection basins will be put at each end of the portals where drainage water will be collected and settled before being discharged into natural watercourses,

Water quality monitoring program will be implemented by the Contractor and Engineer to ensure compliance to water quality standards. Baseline and regular monitoring of water quality shall be undertaken at sites approved by the Engineer, the receiving streams of effluent from construction camps, concrete and asphalt batching plants and other potentially polluting activities related to the construction works as well as from rivers and streams over which bridges shall be constructed. Measurements of suspended solids (SS), biological oxygen demand (BOD), dissolved oxygen (DO), conductivity and fecal coliform, and oil and grease levels are required.

5.3.6 Erosion, Sedimentation, Soil Contamination and Mitigation Measures

The Project is located on a mountain terrain. Therefore the risk of soil erosion will be higher. Soil erosion is expected during earthen works along the banks of rivers which require slope protection that has been made in the design. Silt coming from construction activities can run into rivers causing additional sedimentation. Also, soil erosion can be generated from improper stockpiled excavated earth and topsoil during heavy rainfall events, if slopes of borrow pits are not stabilized and restored properly. These eroded materials ultimately may find their way clogging the canals and drainages. A list of measures to mitigate soil erosion is presented in EMP.

Soil may get contaminated from activities such as handling of construction materials: stones, sand, gravels, bitumen, fuel, lubricants, paints, and disposal of solid waste and sewage. Improper handling of hazardous materials can cause them to drop onto the ground which can result to soil contamination. Improper handling of hazardous materials can lead to their appearance on the ground, which will lead to soil contamination.



Subsequently, given enough time, these materials can penetrate into the ground and reach the water table and result into groundwater contamination and pollution. Soil compaction may take place in haulage roads, construction camps and workshop areas due to movement of construction vehicles, machineries and equipment.

To avoid these impacts the following mitigation measures will be implemented:

- ✓ The storage areas will be paved with gentle slope to a corner and connected with a chamber to collect or recover any oil spills;
- ✓ Solid and liquid wastes will be stored at designated places prior to disposal;
- ✓ To avoid soil contamination at the wash-down and re-fuelling areas, oil Interceptors will be provided;
- ✓ Oil and grease spill and oil-soaked materials will be collected and stored in containers close to fuelling areas;
- ✓ Forbid movement of construction vehicles, machinery and equipment outside of the designated haulage route;
- ✓ Design approach roads to the construction camps and construction areas through the barren land and rocky area to reduce the compaction of soils;
- ✓ Only required vegetation will be cleared and eroded bare slopes will be re-vegetated;
- ✓ Disposal of spoils and debris on the valley side will be strictly prohibited;
- ✓ Ditching, side slopes, and drainage channels will be designed and constructed, as required, during all phases of construction to avoid erosion problems, and ponding over and along roadways from surface water runoff;
- ✓ Erosion control measures will be employed during paving operations to minimize runoff from the construction site, where warranted.

Topsoil stripping and stockpiling activities shall be implemented prior construction works in accordance to RA Land Code (2001), Decision No 1396-N of the Government of RA (2011) and Decision No 1404-N of the Government of RA (2017), getting all necessary agreements and approvals from local and regional authorities. The stockpiled topsoil will be reused as final dressing of embankment and the surplus topsoil will be given back to the communities for their further management according to Land Code.

5.3.7 Impacts and Mitigation Measures Related to Air Quality (Dust and Exhaust Gases)

During the construction phase of the project air quality will be impacted. Emission of CO₂ and NO₂ due to combustion of diesel from vehicles, hot mix plant, batch mix plant, diesel generator sets etc. will pollute air during the construction phase. The main impacts include dust generation, fumes from the hot mix plants, crushers, vehicles and from the transportation of all types of construction material. Fugitive dust generation due to operations such as excavation of construction materials in borrow and quarry areas, loading, transportation and unloading of construction materials, cutting and drilling of rock masses and dust due to other construction



activities. Fugitive dust released during above activity may cause immediate effect on construction workers, inhabitant around the road alignment especially those residing in downward wind direction.

Concrete and asphalt batching plants as well as stone crashing machineries are required to be located at least 1 km away from the nearest sensitive receptor (e.g., communities, protected areas), necessary emission permit shall be secured prior to operation of the mentioned plants and machineries. Necessary emission permits must be obtained prior to the operation of these plants and vehicles.

Operators must install emission control devices. Vegetation should be maintained as much as possible. Watering should be provided on road surfaces, extraction and construction sites to keep them moist and control dust. Trucks carrying dirt, sand or stones should be covered. Concrete mixing plants should not be located near water bodies.

Potential significant adverse impacts upon adjacent residents or workers during construction will be mitigated by watering to prevent dust generation, particularly at crushing machineries. Machinery and equipment are required to be fitted with pollution control devices, which will be checked at regular intervals to ensure that they are in working order.

Emissions from construction equipment such as hot mix plants, stone crushers, diesel generators, haul trucks, pavers, graders, and rollers will be managed through regulatory compliance to emission standards and proper operation and maintenance. No firewood for cooking and heating bitumen and incineration of wastes will be allowed by the Contractor.

Excavation at the tunnel portals will be performed within the enclosed work sheds constructed prior to the commencement of works. Tunnel ventilation air during construction will be treated by passing through particulate filter prior to the exit from work sheds to meet the required standards. Artificial ventilation of underground excavations should be applied at all stages of construction works of tunnels.

Air quality monitoring program will be implemented by the Contractor and Engineer to ensure compliance to ambient air emission standards. Baseline and regular monitoring will be implemented within the construction camps and in community areas close to active road construction fronts, as it will be provided in the Monitoring Plan.

5.3.8 Impacts and Mitigation Measures Related to Noise Level

Operation of vehicles and equipment (including excavators, condensers, pneumatic hammers) and other construction-related activities will occur during construction. The most sensitive to impact are residents of residential areas and buildings adjacent to the road plan.



Without mitigation, increased noise levels would likely result in significant temporary noise impacts. Mitigation measures that will be applied to minimize noise include:

- Siting noise sources away from the communities and sensitive ecosystems, the construction camp including all plants will be located at least 1 kilometer away from the communities;
- Timing of noisy construction activities only between 9:00 to 18:00 to avoid disturbance to nearby communities at night;
- Minimizing the need for heavy vehicles to pass through residential areas by specifying routes along public roads, site access points, and haul routes;
- Installing and maintaining effective exhaust silencing systems on vehicles and equipment;
- Installing temporary soundproofing and sound-absorbing barriers adjacent to tunnels' portals and around noise sources near sensitive sites where other mitigation measures are not sufficient or practicable;
- Providing ear plugs and muffs to all construction workers who are likely to be exposed to elevated noise, ensuring exposure limited to no more than 8 hours at greater than 85 dB.

Noise level monitoring program will be implemented by the Contractor and Engineer to ensure compliance to noise standards. Baseline and regular monitoring will be conducted within the construction camps and in community areas close to active road construction fronts, as it will be provided in the Monitoring Plan.

5.3.9 Impacts and Mitigation Measures Related to Vibration

During construction, equipment may generate vibration at the properties immediately adjacent to the road alignment. Any vibration resulting in nuisance effects will be temporary. Vibration effects will be localized and will unlikely result in structural damage to buildings or walls of the adjacent private properties. However, it is important to note that, some of the structures can be not very well built and cracks can be formed. Being very close to the right-of-way, some structures can be more sensitive to vibration. In case of close proximity of the structures inventory dilapidation surveys will be undertaken by the Contractor prior to construction and again after construction to inspect any damage. Any damage as a result of construction of the Project will either be repaired by the contractor at his own expense or the owners compensated also at the cost of the Contractor. Particular care must be exercised to prevent damage from vibration to archaeological, historical, cultural and natural monuments. It is necessary to ensure that the noise level in the protected areas of the roads is kept at 55 dBA. Whereas vibration is the cause of cracks in walls of structures generated by operation of the particular equipment or machinery (e.g., rollers or compactors) the Contractor shall investigate the use of other equipment or machinery with lower vibration level.



5.3.10 Impacts on Occupational Health and Safety and Mitigation Measures

Road construction exposes workers to various physical hazards that may result to minor, disabling, catastrophic, or fatal injuries. Accidents will happen if safety procedures and practices are not in place. Exposure to loud noise can cause temporary or permanent hearing impairment. Vibration, electrical, welding/works, and working close to moving vehicles also expose workers to injuries.

The Contractor will need to have an effective Occupational Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities.

An environmental and safety orientation training program shall be developed and implemented during all Project phases. Training program shall include training on environmental and health & safety issues organized by Contractor's Environmental and health & safety specialists in accordance with the Safeguard Orientation Plan presented in EMP for all Contractors' Personnel. Engineering staff and workers will be required to attend, an orientation/safety induction course within their first week on site and regularly held trainings for newly recruited workers. On-site workers should be made aware of and trained in standard environmental protection and health & safety requirements.

5.3.11 Impacts on Communities and Mitigation Measures

During construction, communities adjacent to the constructed road section will be exposed to short-term construction-related nuisance effects, including noise, dust, and altered access resulting in cumulative effects. These impacts will largely be mitigated to insignificant levels. Construction activities will likely not occur simultaneously and consequently, there will be no adverse combined impacts during construction. The impacts will however vary depending on the level of exposure and relationship between the contractor, workers and the communities.

Impact on Public. Potentially sensitive receptors will be notified by the Contractors of upcoming construction activities in their area that may result in increased dust, noise, temporary road closures and traffic diversions. This may include media announcements to the general public. Notifications should provide contact details on who to contact to obtain further information or make a complaint.

Utilities. There is potential risk for disruption to above and below-ground utilities during construction. This might include above-ground gas mains, water mains, sewers, and electricity lines as well as irrigation facilities. The Contractor prior to construction shall prepare temporary or permanent relocation and/or protection plan. Any disruption to services should be short-term and localized and will take into account the time of year and time of day. Affected people should be notified prior to the works. Management of this issue will be implemented in accordance with Utilities Protection and Relocation Plan.

Vehicle Movements on Local Roads and Altered Access. The Project will increase heavy vehicle movements on local roads throughout construction from transport of waste, spoil, and construction materials and



machinery. There is potential for disruption to public road access, including diversions where the new road section crosses the existing road, and increased road traffic conflict. The transportation routes will depend on the location of the quarries and the borrow pits that the Contractor will use.

The Contractor shall obtain all necessary permits for traffic movements and shall prepare a Traffic Management Plan during the mobilization period to set out safe entry and exit points, enforce strict safety on public roads in conjunction with local police forces, specify timing for deliveries, and, in conjunction with local governments, determine routes on local roads to manage traffic and minimize potential conflict. These plans will require approval from the police authorities.

Contractors need to emphasize safety among drivers; ensuring drivers have adequate skills, avoiding dangerous routes and times of day to reduce chances of crashes, speed control devices, and regular maintenance of vehicles to avoid premature failure.

Road warning signs, humps should be installed to minimize speed and reduce accidents. Diversion roads should be made and traffic guides put in place to avoid risk of accidents to the community.

Contractor's or its third-party suppliers of fuel, lubricants, and bitumen will be required to demonstrate proofs of capability to handle spills to include:

- i) proper labelling of container content, hazards, and operator's contact details;
- ii) ensure the integrity of the packaging/containers and transport vehicle are commensurate to the hazardous material;
- iii) drivers and assistants are trained on transport and emergency procedures;
- iv) operator has the means to respond to emergencies on a 24-hour basis.

Employment. There are employment opportunities for local people by employing them as part of the project labour force.

5.3.12 Impacts on land acquisition and resettlement

The implementation of the Project will cause permanent changes in land use, and loss of property and other assets caused by occupation of land for the new road section, temporary changes in land uses caused by short term occupation of land for construction, and changes in accessibility to existing land uses resulting from the temporary or permanent presence of the Project.

Prior to the construction, the lands and buildings located in the alienation zone should be alienated and demolished. A generic social impact assessment will be conducted and Soil alienation and resettlement program will be developed. The soil alienation will be carried out in accordance with SARP (SARP general description and principles are briefly presented in Annex 9).



The quantity of alienated lands is described, according to their significance:

Table 11: Quantity of alienated lands according to their significance

Significance	Quantity m ²
Forest	72,681.00
Industrial, earth interior and of other related significance	16,919.00
Residential	290,410.00
Agricultural	922,953.00
Energy, transportation, communication, communal infrastructure objects	111,706.00
Specially protected areas	19,931.00
Water	47,033.00

5.3.13 Impacts on Archaeological, Historical, Cultural and Natural Monuments

The route or contour of the road was set on the basis of GIS with the raster accuracy of 10 m on the maps (ArcGIS 10.4), following which the archaeological, historical-cultural and other monuments subjected to the impact, as documented by the team, have been inserted along the studied areas in the form of historical units. This provides an opportunity to target the units that are under immediate impact or those that remain directly under the road that is going to be built (DUB), as well as those that are not under immediate impact, however, can be at the risk of being destroyed or be partially impacted during the construction works. The collected information was compared to the state list in order to clarify the registered or newly discovered status of the monument. The surface earthen of the monuments, the obsidian objects and other items collected from their surface, which were cleaned and then evaluated, were used for dating the monuments. The distribution of the monuments is presented on GIS based maps (with separate pages, on scale 1:10 000) and with the color coding of the community spaces, their locations in relation to the community, and later also to the route, taking into consideration the road separations per km-picket. The documented units are presented according to their typological classification: burial ground, cemetery, chapel, church, castle, residence, bridge, etc. - units of archaeological, historical and historical-architectural and religious value (see the symbols). A total of 19 units (figures 75 and 76) were documented along the entire route as a result of the indicated works, which are reflected on the units of a total of 46 maps (see figures 75-76 and 121-122), as well as in a separate list (Table 42). More detailed information about the conducted studies and their results is presented in Annex 9.

5.3.14 Environmental and Safety Orientation.

Excess Spoil. Some excessive amount of soil material may be generated. If excess spoil is generated from the excavation and grading activities, the spoil will be classified, transported and disposed in accordance with ME requirements. The Armenian Law on Rates of Environmental Charges (2006), Article 3 provides the environmental charge according to waste categorization these are as follows:

- (i) Category 1 first class hazardousness level – \$133/t;



- (ii) Category 2 second class hazardousness level – \$72/t;
- (iii) Category 3 third class of hazardousness level – \$13/t;
- (iv) Category 4 fourth class of hazardousness level – \$4/t;
- (v) Non-hazardous non-toxic – \$2/t); and
- (vi) Non-hazardous produced during land excavation and construction – \$0.2/t.

Impact on Geology. Tunnel excavation will require extraction of geological resources consisting of sedimentaries i.e., sandstones, shales, limestone and conglomerates and metamorphic i.e., basalts and andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias.

The blasting operations will lead to rock movement, minor fragmentations and vibrations. Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, granular sub base and aggregates for base courses and bridges.

In case of finding of mineralized zones along the tunnel alignment during excavation, it will be brought to the notice of the Ministry of Territorial Administration and Infrastructure.

Appropriate blasting design will be adopted which will consider safety, blast geometry, free faces, burden, spacing, initiation pattern and angled holes.

Oil and Fuel Spills. There is potential for spill or leakage of fuels and oils from inappropriately stored material, during refueling or caused by hose rupture from heavy machinery. This would contaminate the soil and could infiltrate into the groundwater or eventually enter surface water if carried off site through run-off. Mitigation in the EMP sets out measures for avoiding on-site maintenance and re-fueling where practicable, providing bounded areas for fuel storage and maintenance where on-site maintenance activities cannot be avoided, clean-up of any spill/leak, and reporting to the ME in case of spills and leaks.

Solid and Liquid Waste. Solid waste that may be generated during construction includes redundant road surface, excavation material and muck from construction of tunnels, oil filters, material packaging, and solid waste discarded by construction workers. Liquid wastes that will be generated by the Project include construction worker sewage and waste oils. The EMP specifies that waste must be collected, stored, transported, and disposed in accordance with RA legislation and ME regulation.

Excessive soil, oil and fuel spillages and other waste issues are addressed in EMP and will be mitigated by Contractor in accordance with Waste and Material Management Plan as a part of SEMP.

Vehicle Movements on Local Roads and Altered Access. The Project will increase heavy vehicle movements on local roads throughout construction from transport of waste, spoil, and construction materials and machinery. There is potential for disruption to public road access, including diversions where the new road section crosses the existing road, and increased road traffic conflict. It will be the duty of the Contractor to define his traffic movements and access to the site. He will also be responsible for choosing his material and product sources (crushed stone, asphalt etc.). The transportation of material in, from or to the sites of the



Project will include approximately 12.806.112 m³ of excavation, 4.798.338 m³ of embankment and hot asphalt for pavement of 457.608 m².

The transportation routes will depend on the location of the quarries and the borrow pits that the Contractor will use. The awarded Contractor shall obtain all necessary permits for traffic movements and shall prepare a Traffic & Access Management Plan as part of the updated EMP. The relevant transportation scheme shall be inserted in the SEMP.

Traffic and Access Management Plan will be prepared by the Contractor as part of his SEMP during the mobilization period to set out safe entry and exit points, enforce strict safety on public roads in conjunction with local police forces, specify timing for deliveries, and, in conjunction with local governments, determine routes on local roads to manage traffic and minimize potential conflict. These plans will require approval from the police authorities.

Site Reinstatement. By the end of construction phase and prior to handover of the site by the Contractor to the MTAI, the Contractor will reinstate the site which will include clearing the site of all construction-related material and waste and transporting them to sites approved by the Engineer. Landscaping activities should include planting native trees and shrubs as will be provided in the design. All removed trees and shrubs that are not from acquired lands will be replaced with native trees and shrubs at a ratio of 6:1, most of which will be in the vicinity of the alignment consistent with sight distances and available space (e.g., on embankment slopes). The Contractor shall ensure that any plantations are correctly maintained during the works and defects liability period and will engage competent companies to maintain the trees and shrubs following construction. Final payment to the Contractor is subject to the site being restored to satisfaction of the Employer and affected local communities.

Quarries and borrow pits, removal of construction material and topsoil stockpiling. During the detailed design stage information shall be gathered and provided to RD on location of the potential borrow pits, quarries, dump sites and topsoil stockpiling sites. Mentioned data shall contain details about the anticipated environmental impacts, accessibility of the sites, status of the land, maps and all the other type of necessary information for the RD and Contractor to consider exploitation of those sites during construction phase.

5.4 Impact of construction works (calculations)

5.4.1 Air basin

The main emissions of construction works originate during the soil works, as well as utilization of construction equipment, transportation means, and asphaltting works.

Soil works



Dust emissions are formed during soil works. They originate as a result of digging-loading works mainly during the work of excavators, cranes and bulldozers. The digging-loading works are conducted for:

5 years x 10 months x 22 days/months x 8 hours/days = 8800 hours (1100 days).

The calculations were done in accordance with the following formula provided in the methodology "INTERIM PROCEDURE FOR CALCULATING EMISSIONS FROM INORGANIZED SOURCES IN THE INDUSTRY OF CONSTRUCTION MATERIALS" ("ВРЕМЕННОЕ МЕТОДИЧЕСКОЕ ПОСОБИЕ ПО РАСЧЕТУ ВЫБРОСОВ ОТ НЕОРГАНИЗОВАННЫХ ИСТОЧНИКОВ В ПРОМЫШЛЕННОСТИ СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ"), Ministry of Industrial Construction, USSR, 1987.

$Q_{PH.B.} = (P1 \times P2 \times P3 \times P4 \times P5 \times G \times P6 \times B) \times 10^6 / 3600$ t/hour, where

P1 – dust fraction proportion, 0.05 is accepted

P2 – proportion of particles with 0-50 m/km size in the spreading dust aerosol, 0.02

P3 – coefficient which takes into consideration the wind speed in the construction equipment work zone, 1.0,

P4- coefficient which takes into consideration the moisture of the material, 0.4²

P5 – coefficient which takes into consideration the size/largeness of the material, 0.5

P6 – coefficient which takes into consideration the local conditions, 1.0

G – the removed soil mass, 6,000,000 m³ during the entire construction or taking into consideration the average relative density of the ground, 9,600,000 t.

The volume of the ground removed within an hour will be:

9600000 t : 8800 hour/constr. period = 1090 t/hour.

B – coefficient which takes into consideration the height of the material dumping, 0.6

$Q_{PH.B.} = 0.05 \times 0.02 \times 1.0 \times 0.4 \times 0.5 \times 1090 \times 1.0 \times 0.6 \times 10^6 / 3600 = 36.33$ g/sec, or

$36.33 \times 3600 \times 8800 : 10^6 = 1150$ t/constr. Period.

Operation of construction equipment and transportation means

² Taking into consideration the water sprinkler



During the operation of construction equipment and transportation means emissions are formed as a result of burning fuel. Diesel fuel is mostly used.

Emissions related to Dis. Fuel are calculated on the basis of the methodology instructions³ on “Defining emission of hazardous substances from transportation into atmosphere”, developed by the RA Ministry of Environment.

The calculation is implemented according to the amount of the fuel used, in this case it is diesel fuel.

Specific emissions of transportation and construction equipment are presented in table 12 below, in accordance with the mentioned methodology.

Table 12: Specific emissions (g/kg fuel)

Type of fuel	Substance name						
	NO ₂	CH	VoC	CO	N ₂ O	CO ₂ ⁴	CU
Diesel fuel	42.3	0.243	8.16	36.4	0.122	3138	4.3

During the construction, excavators, road rollers, bulldozers, trucks, and special equipment will be used during the construction for the digging works of the tunnel.

Total duration of the construction works – 5 years, the construction equipment and trucks will work – 50 months.

Taking into consideration the absence of specific project data on the fuel cost, indicators/indexes provided in the informational literature on the types of the used technical means were used, according to which the daily cost of the diesel fuel will 22 t/day, during the construction - 24200 t:

Calculations on emissions are provided in Table 12 in accordance with the type of used equipment. Nitrogen oxides were combined, so as were the carbohydrates.

Table 13: Emission calculation results

Adverse substance	Specific emissions, g/kg	Emissions, t
CO (carbon monoxide)	36.4	880
CH (carbohydrates)	8.403	202.15

³ Transportation means classification “Core Inventory of Emissions in Europe” (hereinafter referred to as CORINAIR) is adopted in the methodics, in accordance with the methodology.

⁴ Carbon dioxide, as prescribed by the RA legislation, is not considered an adverse substance and is not subject to fixing, hence it was not included in further calculations.



NO2 (nitrogen oxides, with the count of dioxide)	42.422	1026.6
SP (solid particles)	4.3	104.06

Sulfur Anhydride

Sulfur Anhydride (SO₂) emissions are calculated based on the approach that all of the sulfur contained in the fuel completely transforms into SO₂. In that case the formula of CORINAR inventory system is used:

$ESO_2 = 2 \sum ks b$, where:

ks is the average content in sulfur 0.002 t/t

b is the fuel cost 24200 t/constr. hour

$$SO_2 = 2 \times 24200 \times 0.002 = 96.8 \text{ t.}$$

Asphalting works

The mixture used for asphalting contains melted bitumen, which acts as a source for generating carbohydrates during the foaming of the mixture.

The calculations on carbohydrate emissions were done according to emission calculation manual “Operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe” (EMEP) (Guidebook 2013, SNAP 040611) [Gen-8].

$E_{\text{pollutant}} = A_{\text{production}} \times E_{\text{pollutant}}$, where:

$E_{\text{pollutant}}$ emitted substance (carbohydrates) amount,

$A_{\text{production}}$ – the amount of the used asphalt mixture, 37460 m³, or taking into consideration the relative density (1.6 – 2.3 t/m³, average - 2.0).

$$37460 \text{ m}^3 \times 2.0 \text{ t/m}^3 = 74920 \text{ t}$$

$E_{\text{pollutant}}$ – relative index of the emissions of the given substance (carbohydrates), 16 g/t (table 3.1):

$$E_{\text{pollutant}} = 74920 \text{ t} \times 16 \text{ g/t} = 1198720 \text{ g or } 1.2 \text{ t}$$

Total amount of emissions are provided in Table 14.

Table 14: Construction work emissions



N	Adverse substance	Amount of emissions caused by the construction, t
1	Inorganic dust	1150
2	Carbon monoxide	880
3	Carbohydrates	203.35
4	Nitric oxides (calculated as nitric dioxide)	1026.6
5	Solid particles	104.06
6	Sulfur dioxide	96.8

5.4.2 The results of terrestrial concentration calculations

In order to evaluate the impact of emission, a calculation of their dispersion in the atmosphere was conducted and the results were compared to sanitary norms.

Calculations of adverse emission in the atmosphere have been conducted in a computer, by “Era” software, based on the data provided in Table 13.

Taking into consideration the peculiarity of the presented activity, that is, the construction of the road with a length of 45 km, during which emissions practically are distributed evenly along the entire road, the sections of each 90 m of the road were considered as a conditional emission source. The selection of the length of the section is based on the capacities of “Era” computer software, the length of the platform source should be less than 100 m. Hence, the number of conditional platforms will be:

$$45000 \text{ m} : 90 \text{ m} = 500 .$$

The platforms can also be conditionally divided into two groups, based on the local meteorological conditions – Kajaran group and Meghri group, each having 250 platforms. The relief index for the Kajaran group varies between 1.3 and 1.7, the average – 1.5, and for the Meghri group – between 1.1 and 1.4, average – 1.3.

Although the greater section of the road is not related to the residential areas, the manual of the “Hydrometeorological and monitoring center” SNCO of the RA Ministry of Environment was used as background pollution in the dispersion calculations, where the indexes are calculated according to the population number.

According to the dispersion calculations, the following are defined:

- calculated point coordinates, m;
- riverbed concentrations of adverse emissions TLV;
- the direction of the chandelier axis;



- wind speed of m/sec, in which case the surface concentration reaches the value of the best.

Nitrogen dioxides and sulfur anhydride have a summary feature.

The calculation results are presented in Annex 16.

According to those calculations, the highest level pollution are permissible during two-0three conditional platforms.

The calculations made on two conditional platforms are provided below – one for the Kajaran group and one for the Meghri group.

Table 15: Results of terrestrial concentration calculations

N	Pollutants	Maximum one-time TLV, mg/m ³	Maximum riverbed concentrations			
			Kajaran group		Meghri group	
			On TLV	mg/m ³	On TLV	mg/m ³
1	Inorganic dust	0.5	0.4	0.2	0.4	0.2
2	Carbon monoxide	5.0	0.08	0.4	0.08	0.4
3	Carbohydride ranges	1.0	0.0009	0.0009	0.0008	0.0008
4	Nitrogen dioxide	0.2	0.04 (0.05 ⁵)	0.008	0.04 (0.05 ⁶)	0.008
5	Solid particles (soot)	0.15	0.0093	0.0014	0.0077	0.0012
6	Sulfur anhydride	0.5	0.04	0.02	0.04	0.02

5.4.3 Water usage and water drainage

Water usage

During the construction works water is used for the needs of the local water sprinkler, soil mass moisturizing, as well as for the drinking and household needs of the construction staff.

a) Water sprinkling of platforms

During the road construction numerous large and small construction sites will be built. Their average total area will be 800 m².

⁵ Taking into consideration the feature of compounding with sulfur anhydride

⁶ Taking into consideration the feature of compounding with sulfur anhydride



The capacity of the water sprinkler is 1.5m/m²:

During warm weather water sprinkling is organized twice a day.

The water demand of the daily water sprinkling will be:

$$800 \text{ m}^2 \times 2 \times 0.0015 \text{ m}^3/\text{m}^2 = 2.4 \text{ m}^3/\text{day}.$$

The average annual number of warm days without precipitation is $144 - 5 \times 144 = 720$ days during the entire construction.

The water demand per one site is $720 \text{ days} \times 2.4 \text{ m}^3/\text{day} = 1728 \text{ m}^3/\text{constr}.$

Envisage and at the same time operate 7 sites simultaneously.

$$691.2 \text{ m}^3 \times 7 = 12096 \text{ m}^3/\text{constr}.$$

b) Soil mass moisturizing

A soil mass of a total of 6000000 m³ will be dug and removed. Moisturizing norm is accepted with 8 l/m³.

$$6000000 \text{ m}^3 \times 8 \text{ l}/\text{m}^3 : 1000 \text{ l}/\text{m}^3 = 48000 \text{ m}^3$$

g) Drinking household water

The estimated water costs are defined in accordance with OUDRA⁷ 2.04.01-25 norms.

Daily, per a worker – 25 liters

Daily, per an administrative employee – 16 liters

The construction staff will consist of 300 people, including 40 engineer-technicians (ET).

The water cost for the employees drinking and household demands is $W = (n1 \times N1 + n2 \times N2) \times T$, where

n1 – number of ET workers	40 people
N1– normative of ET water cost:	0.016 m ³ day/person
n2– number of workers:	260 people

⁷ ORDER OF THE MINISTER OF URBAN DEVELOPMENT OF THE REPUBLIC OF ARMENIA



N2 – normative of workers’ water cost: 0.025 m³day/person

T – number of the working days is 8800 days

$$W = (40 \times 0.016 + 260 \times 0.025) \times 8800 = 62832 \text{ m}^3:$$

Water supply will be carried out from water network located along the constructed road, at the cost of the communities’ limits/restrictions.

Water drainage

No leakage will be caused due to the moisturizing of the water sprinkler and soil mass moisturizing.

Wastewater originates only as a result of using the drinking and household water.

The calculated amount of economic household waterflows will be:

$$W_{\text{sewerage}} = W_{\text{household}} \times (1 - \text{losses}), \text{ where:}$$

The losses are generalized to 5 percent /0.05/,

$$W_{\text{sewerage}} = 62832 \times (1 - 0.05) = 59690 \text{ m}^3:$$

It is planned to rent spaces in the residential areas along the road for household (bathrooms, catering rooms, other rooms, etc.) needs. The areas will be ensured with water supply and sewerage systems.

Table 16: General calculated indexes of the water use and drainage

Water use demands	Water usage, m ³ /year	Losses, m ³ /year	Water drainage, m ³ /years
Platform sprinkling	12096	12096	-
Soil mass moisturizing	48000	48000	-
Drinking and household	62832	3142	3142
Total	122928	119786	3142

5.4.4 Soil resources

Extraction

Soil and ground of 6000000 m³ is dug and removed during the road location and construction site preparations. A part of this extraction - 1200000 m³ is used as a backfill. The rest - 4800000 m³ for developing the internal and final formation, as well as for flattening and improving the road.



Topsoil

The topsoil layer of the envisaged road construction affected area mostly varies between 15 – 25 cm. The total volume of the topsoil subject to removal is approximately 105000 m³.

The topsoil will gather in separate locations of specially designated areas of the 5 dumps and in the composition of the dumps to be near the work platforms, and will be used for improving the local area. The location, coordinates, characteristics, and maps are provided in Annex 10.

The cutting, storing and maintaining of a topsoil, ensuring further use in compliance with the decision of the RA government N 1404-n, 02.10.2017 “ON REQUIREMENTS FOR THE TOPSOIL LAYER REMOVAL NORM DEFINITION AND THE PRESERVING AND TOPSOIL LAYER MAINTENANCE AND USE”.

Wastes

The waste generation sources can be classified as follows:

- Main - construction,
- Auxiliary – transportation and construction equipment service, supply, household service of employees.

Construction wastes

Wastes from auxiliary processes

a) used motor oil wastes` 8,4 t

Classifier: 5410020102033

Composition: petroleum, paraffines, and synthetic combinations.

Characteristics: explosive, causes soil and water pollution.

The wastes originate as a result of using the motors of transportation and technical means. Oils are calculated for a certain period of time, after which they are replaced with new quantities, when they lose the necessary peculiarities.

The used oils contain metal in their compositions, and later sold to licensed companies that deal with recycling of oil:

a) Inhabited tire cover` 3,4 t.

Classifier 5750020213004



Composition: rubber-95%, metal wires (cord) – 5%.

Characteristics – is explosive.

The wastes originate during the usage of transportation and technical means. Tire covers are regularly replaced by new ones.

The wastes are collected and maintained in areas specially designated areas for the purpose of selling it to licensed companies for the purpose of selling it to licensed recycling companies for selling it.

c) Inhabited lead accumulators and spoilage - 1,7 t/year.

Classifier: 92110100 13 012

Composition: networks that contain lead, solutions with lead oxides and sulfuric acid, as well as plastic molds.

Characteristics: is not explosive, it is toxic for the environment and people's health, the sulfur acid causes skin burns.

The wastes originate as a result of using transportation and technical means. Lead accumulators are constantly being replaced with new ones.

The used lead accumulators are collected in the separate room of automotive, later sold to licensed organizations dealing with the trade of accumulator waste.

d) Unsorted steel containing wastes (including steel dust) - 2,8 t/years.

Classifier: 3512011101004

Composition: iron, carbon

The waste is not toxic.

This waste originates during the use of mining equipment and transportation. The wastes are accumulated in special locations, under a roof and are sold to respective licensed companies.

The following companies are among licensed organizations that deal with recycling of industrial waste: "Meteqsim" LLC, "AM SK" LLC, "G. Nazaryan and Inc" LLC, and "Ecology V.K.H." LLC, etc.

e) Construction waste

Classifier: 3990120001004



The waste is not toxic.

This type of waste is generated as a result of various construction works (demolition, excavation, etc.). Waste is accumulated directly on construction sites and / or in specially designated areas (if necessary) and transported to a landfill agreed with the relevant municipality.

f) household waste

The household waste is originated as a result of the household service of engineer-technical workers, as well as during administrative activities.

The waste is accumulated in waste baskets, in accordance with a respective contract, they are moved to the allocated land nearest the dump allocated from the nearby authorities.

Calculated amount of household waste` 48 t.

5.4.5 Noise

While using construction equipment and trucks certain noise is caused during the construction works. Different technical means are there. Different technical equipment pieces have different indexes of noise which vary between 65 up to 96 dB.

However, the amended project does not cross residential districts or children's and public constructions hence the impact will not be there, especially that the technical means are going to be used only during daytime.

5.5 Calculation of economic impact posed on environment

The assessment of possible economic impact on environment is conducted based on the environmental components. The economic damage is calculated in accordance with the decision of the RA Government N 764-N dated 27.05.2015.

The possible economic damage is calculated:

$$\text{ЧS} = \text{ЗУQ} + \text{ЭУQ} + \text{ОУQ}, \text{ where:}$$

ЧS is the possible economic damage in monetary expression,

ЗУQ is the value assessment of the damage caused by economic activity on soil resources (pollution of natural environment, impoverishment of natural resources, destroying or damaging ecosystems, or negative changes made to the environment), which is calculated in accordance with the decision of the RA Government N 92-N, dated January 25, 2005.



ՉԱԳ is the assessment of the results caused by direct and indirect economic activity impact on water resources, which is calculated in accordance with the decision of the RA Government N 1110-N, dated August 14, 2003.

ՕԱԳ is the value assessment of the damage caused on atmosphere as a result of economic activity impact, which is calculated in accordance with the decision of the RA Government N 91-N, dated January 25, 2005.

5.5.1 Atmospheric air

The economic damage is the value the necessary measures taken for mitigating the damage caused to the environment, with a monetary expression.

The economic impact takes into consideration:

costs related to health deterioration of the population,

the damage caused to agriculture, forestry and fish farms,

the damage caused to industry.

The economic damage was calculated in accordance with the “Order of Assessing the Impact on Atmosphere caused by Economic Activities”, as prescribed by the decision of the RA Government N 91-N, dated 25.01.2005.

The damage caused to the economy for each emission source is assessed with formula 1:

$U = \zeta_q \Phi_g \sum \psi_i \rho_i$, where

U is the impact expressed by Armenian Drams,

ζ_q is the index expressing the characteristics of the pollution source environment (active pollution zone), is 5 for the category of the industrial spaces specified in Table 9 and 5 for mobile sources.

In this case the construction equipment operates on the local platform and may be classified under immobile sources, whereas the transportation means - under mobile sources.

Φ_g is the transportation index, it is fixed and is selected based on the principle to promote the environmental process. According to this order:

$\Phi_g = 1000$ AMD.

ψ_i is the expressed volume comparable harmfulness size of the i substance (type of dust),

ρ_i is the index connected with the amount of emissions of the given (i) substance,



P_i index is defined by formula 2:

$$P_i = g (3 S_{U_i} - 2 MPC_i), S_{U_i} > MPC_i (2), \text{ where:}$$

MPC_i is the quantity of permissible threshold annual emissions of the i substance in tons.

S_{U_i} is the annual actual quantity of emissions of i substance in tons.

Taking into consideration that the emissions of hazardous substances will be made along the road, are going to be short-term, and mostly from mobile sources, $P_i = S_{w_i}$:

$$q = 1 \text{ for immobile sources,}$$

$$q = 3 \text{ for mobile sources.}$$

The substances the normative concentration of which is not defined by state standards, is not evaluated.

During the calculations, mobile and immobile sources have been distinguished.

The estimation of the economic damage caused as a result of the construction of the Kajaran-Agarak road section, is presented in Table 17.

Table 17: Estimation economic damage caused as a result of the construction

Names of pollutant's	Indicators required for calculation			ψ	ζq	Economic damage. AMD $U = \zeta q \Phi g \sum \psi_i P_i$
	S_i	q	$P_i = S_i \times q$			
Inorganic dust	1150	1	1150	10	4	46000000
Carbohydrates	1.2	1	1.2	3.16	4	15170
Carbon monoxide (mobile source)	880	3	2460	1	5	12300000
Carbohydrates (mobile source)	202.15	3	606.45	3.16	5	9581910
Nitrogen dioxide (mobile source)	1026.6	3	3079.6	12.5	5	192475000
C.U. (mobile source)	104.06	3	312.18	41.5	5	64777350
Sulfur anhydride (mobile source)	96.8	3	290.4	16.5	5	23958000
Total						349107430

The economic damage calculated as a result of the construction of the Kajaran-Agarak highway section will make 349107430 AMD.



5.5.2 Water resources

As a result of the construction of the road, there is no polluted drainage, rainwater and snowmelt flows, mostly due to bypassing streams, are removed from the site without contamination. Accordingly, economic damage is not calculated.

5.5.3 Soil resources

As a result of the construction of the north-south road corridor, the importance of land use is changing; it will serve as a highway, but pollution can not be considered; economic damage is not calculated.

5.5.4 Biodiversity

Trees will be cut down in several areas during the works. To compensate for these cuttings, it is planned to plant selected tree species in a ratio of 1: 2. The cost of planting trees is included in this report as damage to biodiversity.

A total of 19,366 trees are planned to be cut down. According to the accepted practice of the Republic of Armenia, 1500-2000 saplings are placed on 1 hectare of territory. According to preliminary calculations, the costs will be:

$19366 \text{ piece} \times 2 : 1500 \text{ piece} \times 3.0 \text{ million AMD} = 77.46 \text{ million AMD}$:

The total economic damage will be: $349166391 + 77464000 = 426630391 \text{ AMD}$:

5.6 NEGATIVE IMPACTS AND MITIGATION MEASURES DURING OPERATION PHASE

5.6.1 Impacts on Flora

Improper maintenance of re-instated sites may result in the losses of planted trees and shrubs. To avoid this impact, measures are considered in the EMP (Appendix 2).

5.6.2 Impacts related to Air quality

The slight deterioration in air quality that may be caused by increased traffic due to the Project is expected to be insignificant.



5.6.3 Impacts related to Noise quality

Operational noise levels are predicted to be increased in areas close to the Project.

5.6.4 Impacts related to water quality

In the period of operation changes in the quality of surface water is expected to be minimal. No adverse effects on groundwater are expected during the operation phase, as geological surveys have revealed that groundwater is very deep in the entire road area, at a depth of more than 30 m.

5.6.5 Impacts related to protected area

No significant impact is expected on specially protected areas, as research has shown that there are no animal migration routes on the section of the road where Arevik National Park is located, as well as endangered species populations. However, there will be some impacts that can be avoided or mitigated through the implementation of an Environmental Management Plan.

5.7 CUMULATIVE ENVIRONMENTAL EFFECTS

During construction, receptors adjacent to the route will be exposed to short-term construction-related nuisance effects, including noise, dust, and altered access resulting in cumulative effects. These impacts will largely be mitigated to insignificant levels. Construction activities will likely not occur simultaneously and consequently, there will be no adverse combined impacts during construction.



6. ANALYSIS OF ALTERNATIVES

ADB security document (2009) and the Armenian legislation requires taking into account the implemented alternatives to the program in terms of the placement of the program and project, allowing the proposed means to avoid or prevent possible environmental consequences.

The "no program" alternative is not considered viable, since the trip duration is longer and the cost is more expensive than in the case of other options, the negative impact of vehicle emissions on air quality in cities (where the highway passes) is higher, and there are more safety problems for both road users and people with traffic problems than in the case of alternative options. This is contrary to the development programs of large communities such as Kajaran and Meghri.

Despite the fact that local residents will be affected by land alienation and community, in the long term, the availability of markets, medical facilities, and administrative services will improve.

During the process of the feasibility study six alternatives (numbered 1 to 6) were studied and only 2 alternatives were selected to be further developed after application of the Value Engineering in selection: A1 and A2 were selected. During the preliminary design preparation stage both alternatives considers and several ones suggested.

During the preliminary design phase 2 new options proposed besides the version of FS. New options were prepared based on the FS results.

1. New design BLUE80: March 2020
2. New design CYAN100: March 2020
3. The feasibility study design: April 2014

The road alignment and location of project area are shown on the Figure 30.

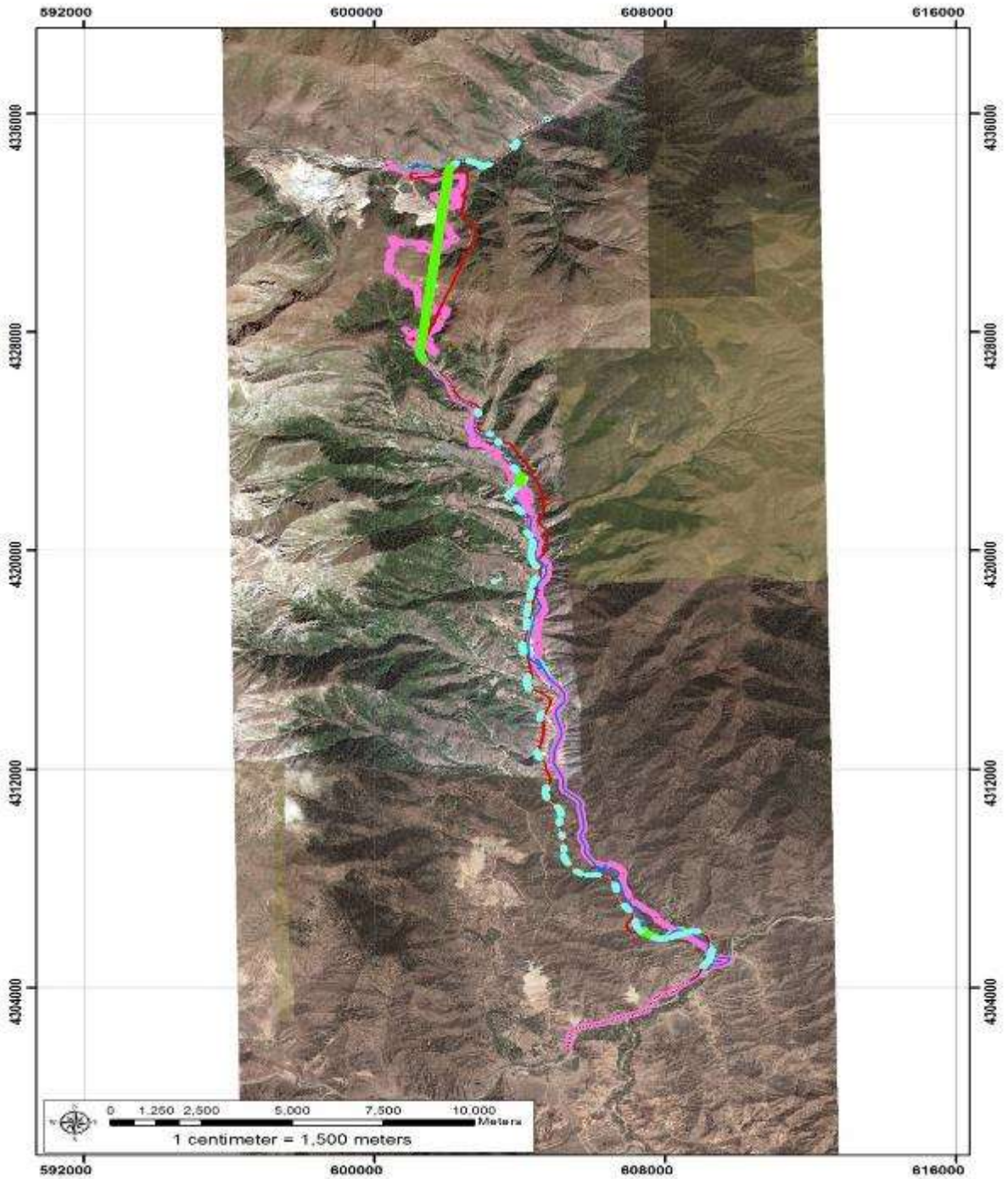


Figure 30: Road alignments for FS, BLUE 80 and CYAN 100. ■ is for FS ; ■ is for BLUE 80, ■ is for CYAN100, ■ is for pre-existing M2 road



In addition to the suggested alternatives, it is necessary also consider the “without project” option. It presupposes the maintenance of a baseline state, which will have the following positive and negative consequences.

Positive consequences.

- No construction traffic and activities that could have a negative effect on air quality
- No impact on indigenous species along existing road
- No need of infiltration drainage to compensate for construction of impermeable road surface
- Moderate risk from road run-off to surface water and groundwater
- No cultural heritage resources will be impacted
- No agriculture land acquisition neither expropriation/demolition of private properties
- No environmental management system will be needed

Negative consequences.

- Further deterioration of existing Kajaran-Agarak road section and associated infrastructure
- Increased operation and maintenance costs for road infrastructure
- Higher risk of accidents due to the deteriorated condition of the pavement, lack of safety elements, landslide prone zones, etc.
- Increase in vehicle maintenance costs for both commuters and cargo transporters, potential consequent increase in transportation prices
- Reduction of income of the rural population
- Increased migration from rural areas
- Other negative consequences, not only for Kajaran and Meghri communities, but also for Republic of Armenia in total.

An environmental screening and classification of a project has been implemented aiming to compare the potential environmental/ social impact caused by 3 proposed options of the road alignment: Option 1- Feasibility Study, Option 2- Blue 80 and Option 3- Cyan 100 based on the desk study of project area (Rapid Environmental Assessment (REA) Checklist presented in Annex 1).

The comparative analysis of alternatives focuses on environmental (including archaeological) issues and concerns, the social dimensions are also considered.

All 3 proposed options are screened versus Armenian legislative requirements (RA Law on Environmental Impact Assessment and Expertise, 2014) and ADB Safeguard Policy Statement (SPS 2009). The results are summarised in respectfully in Table 18 and Table 19.



Table 18: Screening on RA requirements

Option	Environment category RA	Impact assessment report required	Environmental expertise and RA MoE approval	Public consultations
Option 1- FS	A	EIA/ EMP	Yes	4
Option 2- BLUE80	A	EIA/ EMP	Yes	4
Option 3- CYAN100	A	EIA/ EMP	Yes	4

Table 19: Comparisons of alternatives

Alternative	Pros	Cons
Without project /Kajaran-Agarak section of the existing M2 Yerevan-Ararat-Yeghegnadzor- Goris-Kapan-Kajaran-Meghri highway /	<ul style="list-style-type: none"> •No generated traffic due to better infrastructure •No Construction traffic and activities that could have a negative effect on air quality •No impact on indigenous species along existing road •No need of infiltration drainage to compensate for construction of impermeable road surface •Moderate risk from road run-off to surface water and groundwater •No cultural heritage resources are impacted •No agriculture land takes neither expropriation/demolition of private properties •No environmental management system needed during construction 	<ul style="list-style-type: none"> •Negative impact on air quality in inhabited centres crossed by route •No improvements to the public and private transport infrastructure •No Diversion traffic away from the congested urban centres, diminishing journey time, costs and vehicle emissions •Safety issues both for road users along sections with single carriageway, and for weak users/pedestrians for lack crossing facilities •Moderate level of risk of chance finds, which will require the archaeological excavations
Alternative 1 /BLUE 80/	<ul style="list-style-type: none"> •Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centres crossed by route •Potential to plant indigenous species in road areas with 	<ul style="list-style-type: none"> •Construction traffic and activities will have a temporary negative effect on air quality •The route passes through the forest and protected area •Moderate level of risk from road run-off to surface water



	<p>embankments</p> <ul style="list-style-type: none"> • Unlikely that any cultural heritage resources will be significantly impacted • Associated improvements to the public transport infrastructure • Agricultural areas land take is very moderate since the corridor interests' steep, with a long tunnel and in general mountainous profiles • Ensure road safety by proper signage, guard rails, safety barriers and road markings • Employment opportunities for construction and maintenance of local labor • Enhance accessibility to tourist valence sites • Diversion traffic away from the congested urban centres, diminishing journey time, costs and vehicle emissions 	<p>and groundwater</p> <ul style="list-style-type: none"> • Moderate (lower than other options) level of risk on disfiguration of landscape by road embankments, cuts, fills, and borrow sites • Moderate level of risk of chance finds, which will require the archaeological excavations
<p>Alternative 2 /CYAN 100/</p>	<ul style="list-style-type: none"> • Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centres crossed by route • Potential to plant indigenous species in road areas with embankments • Unlikely that any cultural heritage resources will be significantly impacted • Associated improvements to the public transport infrastructure • Agricultural areas land take is very moderate since the corridor interests' steep, with a long tunnel and in general mountainous profiles • Ensure road safety by proper signage, guard rails, safety barriers and road markings 	<ul style="list-style-type: none"> • Construction traffic and activities will have a temporary negative effect on air quality • The route passes through the forest and protected area • Moderate level of risk from road run-off to surface water and groundwater • Moderate level of risk on disfiguration of landscape by road embankments, cuts, fills, and borrow sites • Moderate level of risk of chance finds, which will require the archaeological excavations



	<ul style="list-style-type: none"> •Employment opportunities for construction and maintenance of local labor •Diversion traffic away from the congested urban centres, diminishing journey time, costs and vehicle emissions •Enhance accessibility to tourist valence sites •Diversion traffic away from the congested urban centres, diminishing journey time, costs and vehicle emissions 	
Alternative 3 /The feasibility study design /	<ul style="list-style-type: none"> •Better geometry of route (minor grades, higher curves radiuses, more constant speed) will reduce impact on local air quality in inhabited centres crossed by route •Potential to plant indigenous species in road areas with embankments •Unlikely that any cultural heritage resources will be significantly impacted •Associated improvements to the public transport infrastructure •Ensure road safety by proper signage, guard rails, safety barriers and road markings •Employment opportunities for construction and maintenance of local labor •Enhance accessibility to tourist valence sites •Diversion traffic away from the congested urban centres, diminishing journey time, costs and vehicle emissions 	<ul style="list-style-type: none"> •Construction traffic and activities will have a temporary negative effect on air quality •The route passes through the forests •Moderate level of risk from road run-off to surface water and groundwater •Moderate level of risk on disfiguration of landscape by road embankments, cuts, fills, and borrow sites •High risk of chance finds, which will require the archaeological excavations

The following conclusions are drawn:



1. According to RA Law all 3 road alignment options are classified as an Environment Category A and will require full scale Environmental Impact assessment, 2 EIA/EMP reports, 2- stage Environmental expertise procedure, 4 public consultations and expertise positive conclusion. The desk screening didn't reveal any impact which might fall under the RA legislative restriction and exclude the project activity in the area for neither of options.
2. According to ADB SPS (2009) all 3 road alignment options are classified as an Environment Category A and will require full scale Environmental Impact assessment, EIA/EMP report, at least 2 public consultations and EDB approval. The Rapid Environmental Assessment (REA) screening didn't reveal any impact which might fall under the ADB SPS restriction and exclude the project activity in the area for neither of options (see Annex 1);
3. All 3 road alignment options will touch the area of Special Protected Nature Area – Arevik National Park under Zangezour Biosphere Complex.
4. All 3 road alignment options will not escape the Special Protected Cultural Area, the encroachment into the archaeologically sensitive areas is unavoidable (see the archaeological report in Annex 6). But the impact will be minimized by the Option 2 Blue 80 and Option 3- Cyan 100 because:
 - ✓ Number of sites which will be directly affected by the alignment is significantly higher at Option 1- FS. These sites will need the archaeological excavations and MESCS approval;
 - ✓ Presence of sites located within the specially protected archaeological areas which will need the change of land category is also much higher by the Option 1 –FS.
 - ✓ There are no critical cultural/ archaeological areas impacted by neither of options. All the monuments can be protected by archaeological excavations. But the probability of chance finds which will require the archaeological excavations is also higher at Option 1- FS.
5. All 3 roads alignment options led to the disfiguration of landscape by road embankments, cuts, fills, and borrow sites. On the other hand, this impact will be minimized by the option 2 BLUE 80 due to the circumstance that only this option proposes about 10km upgrading of the pre-existing M2 road.
6. The tree fall is not avoided by neither of options, but is minimized by the Option 2 BLUE80 again due to the circumstance that 10Km of upgrading of existing M2 HW is proposed.
7. All 3 road alignments do not interfere with the hydrology of surface water bodies in terms of changing the water course of the rivers and/ or quality of the water. The impact on the rivers will be restricted by temporary bridge construction related impacts easily mitigated by the EMP.
8. All 3 options are designed based on the principle avoiding the interference with communities. But again Option 2 BLUE 80 has got an advantage because avoids the irreversible impact on the local road network while Option-1 FS destroys the local roads without proposing any solution for the joint to the NSRCP.
9. Due to the larger length of the tunnel proposed by the Options 2 BLUE80 and Option 3 CYAN 100 - about 7km – more quantity of embankment rock material will originate versus the Option1 FS (about 4.5km) which will reduce the burden on the borrow material sites. In case of the Option 1 FS likelihood of borrowing rock material for embankment is higher.
10. The land alienation and dislocation of people will not be avoided by neither of all 3 options: Option 1 –FS is preferable in terms of alienation of land plots and is worse one in terms of involuntary dislocation of people



living within RoW. Option 3-CYAN100 is most preferable in terms of dislocation of people and the Option 2-BLUE 80 suggests the medium impact on the people living within the alignment.

11. The Cultural heritage impact is equivalent in all 3 Options (no significant and critical cultural heritages appeared in the area by official registers and equivalent desk studies).
12. “Without project” option will exclude all the anticipated negative environmental impacts from construction and operation of the new road, that mostly will be temporary, but at the same time, all positive social and economical effects that will take place after exploitation of the new road both local and national significance will be excluded too.

Based on the above conclusion can be drawn that the Option- 2 BLUE80 is the most preferable.



7. INFORMATION DISCLOSURE, PUBLIC COMMUNICATION, CONSULTATION AND PARTICIPATION

The Public communication, consultations and participation shall be carried out in compliance with Armenian legislation, donor organization safeguards policy and in accordance with Public Consultation and Communication plan that will be developed by the Contractor in the scope of the present EIA and EMP.

The Public Consultation and Communication plan includes:

- Disclosure of Project related Information to raise the awareness of the public on the Project.
- Public consultations will be implemented to meet requirements of the donor organization safeguards policy and RA legislation to ensure the participation of the public and affected people on the design and EIA drafting stage of the project. The public consultations shall be implemented during the detail design stage. Should the design or another significant change in project implementation occurred during construction phase, the Contractor with assistance and participation of the Engineer and RD will organize another public consultation.
- Grievance Redress Mechanism to ensure the everyday permanent communication with affected people for prompt response and resolution of complains and suggestions.

The mitigation measures related to public consultation and communication are presented in the EMP.

7.1 INFORMATION DISCLOSURE

The Public communication, consultations and participation shall be carried out in compliance with ADB SPD (2009) and Armenian legislation. The draft EIA including EMP will be disclosed to the public in English and Armenian languages in the early stage of final design preparation. The draft EIA will be posted on the RD website. All the suggestions will be considered in the final EIA that will also be disclosed to the public in English and Armenian languages, and posted on the RD and donor organization websites. This will ensure the disclosure of environmental concerns and proposed mitigation measures, and make available environmental documents available to the public, the relevant authorities and other interested parties.

7.2 CONSULTATION AND PARTICIPATION

The Public consultation and participation are the opportunity for the Project to incorporate all relevant views of affected people and other stakeholders into the Project design, mitigation measures, and monitoring plan. The consultation with affected people and other concerned stakeholders, including local persons, will be carried out on an ongoing basis throughout the Project cycle to provide timely disclosure of relevant and adequate information that is understandable and accessible to affected people and responsive to the needs of disadvantaged and vulnerable groups; and should enable to incorporate all relevant views of affected people



and other stakeholders into the mitigation measures and implementation issues.

According to the RA Law "On Environmental Impact Assessment and Expertise" for Projects classified as Category A two stages of expertise process will be required with 4 public consultations. Before submission of the first stage lasting 30 working days the public shall be notified on the project and first public consultation organized. The Ministry of Environment undertakes classification of a project during the first stage and after second public consultations recommends TOR for the EIA, if the EIA is required according to the classification outcome.

At the second stage, a final EIA report shall be presented to the public (3rd public consultation) and after submitted to the Ministry of Environment. The Ministry undertakes its review during 60 days for a category A project. 4rd consultation meeting are required at this stage. The Ministry may extend the review deadline for up to 30 days after which it issues a positive or a negative conclusion of the expert review.

It is worth mentioning that public consultation shall be organized based on the requirements of the RA Government Decree No. 1325-N of November 19, 2014 and the RA Law "On Environmental Impact Assessment and Expertise".

The process and activities in the conduct of public consultation (i.e., program schedule, project information handouts, attendance sheet, complaints, issues and concerns raised by participants), and its results (e.g., agreements, and resolutions) will be documented.

The Public Consultation procedure under the EIA legislation of Armenia is presented hereafter:

- (i) the authorized body – regarding the application submitted by the Initiator for the report and expertise draft conclusion at least 7 working days prior to the public consultations;
- (ii) the Initiator – regarding the conceptual/framework document and the envisaged activities and implementation of their impact assessment activities at least 7 working days prior to the public consultations;
- (iii) territorial administration bodies and the head of the affected community – regarding the conceptual/framework document and the envisaged activities and implementation of their impact assessment activities at least 7 working days prior to the public consultations.

The content of the notification should contain the details of the Initiator, the place of implementation, the summary description of the envisaged activity or the conceptual/framework document, the place of getting acquainted with them and conducting discussions, the conditions, the timeline of providing comments and proposals and other information.

The notification and the design documents should be also placed at the official websites of the authorized body at least 7 working days prior to the public consultations.

Public consultations will be carried out by:



The Initiator – regarding the conceptual/framework document, the envisaged activities and the assessment processes of their impacts,

Territorial administration body, the Initiator - regarding the conceptual/framework document and draft report on strategic assessment of their impact,

Territorial administration body, the Initiator - regarding the envisaged activity and report on its impact assessment.

The authorized body ensures the participation of its representative in the discussions.

Based on the results of public consultations the Initiator makes a protocol attached with video recording.

The reasonable comments and proposals by the public should be considered by the Initiator and the authorized body. In case of neglecting, justifications should be provided.

The consultation with affected people and other concerned stakeholders, including local persons, will be carried out on an ongoing basis throughout the Project cycle to provide timely disclosure of relevant and adequate information that is understandable and accessible to affected people and responsive to the needs of disadvantaged and vulnerable groups; and should enable to incorporate all relevant views of affected people and other stakeholders into the mitigation measures and implementation issues. The consultation process and its results will be documented.

The ADB SPD 2009 policy on Public Consultation is a process with a requirement to engage with communities, groups, or people affected by the proposed Project and with civil society. It:

- (i) begins early in the Project preparation stage and is carried out on an ongoing basis throughout the Project cycle;
- (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- (iii) is undertaken in an atmosphere free of intimidation or coercion;
- (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

Prior to the preparation of this EIA report, during the preliminary stage of the expertise, two public discussions were held in Meghri community and two public discussions in Kajaran community, materials of which (protocols, pictures) are available in Annex 11.



8. GRIEVANCE REDRESS MECHANISM

8.1 GRIEVANCE REDRESS MECHANISM

8.1.1 Grievance Redress Mechanism

In order to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance an Environmental Grievance Redress Mechanism is proposed for the project. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the implementation of project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism is not impeding access to the judicial or administrative remedies. The project proponent will appropriately inform the affected people about the mechanism before start of commencement of any civil works.

8.1.2 Grievance Focal Points, Complaints Reporting, Recording and Monitoring

The process for solving environmental complaints that may arise in the project is the Grievance Redress Mechanism, which will be established at each community in which the various project components will be implemented.

The existence of a GRM will be disclosed to the APs in the EIA and LARP finalization stage during the public consultations. The GRM will ensure that the aggrieved parties have reasonable access to sources of information, advice, consultation and expertise necessary to engage in a grievance redress process on fair and equitable terms. The Grievance Focal Point will be the representative of RD. The schedule of meetings with GFP will be performed with having at least two meetings per month will be implemented in every affected community. Some additional meetings may be necessary in communities where numerous issues arise. GFP will set a timetable of his/her presence in the village for host of grievances which will be disclosed to the APs by the local authorities and put up at public places. Each Local Self -Governing Bodies (LSGB) Office nominates the representative who will be responsible for the collection and provision of complaints/requests/claims to GFP or directly to RD.

Both LSGBs Office and GFP will be responsible to collect/register and forward to RD the complaints/requests/claims with all required documentation. Nevertheless, the above-mentioned access points do not limit the citizen's right to submit their grievances/requests/claims directly to RD and/or MoTAI. Besides, an aggrieved person is free to access the country's legal system for the redress of his/her grievances at any stage of the GRM.

The procedural steps of the Grievance Redress Mechanism for the Project are provided below.

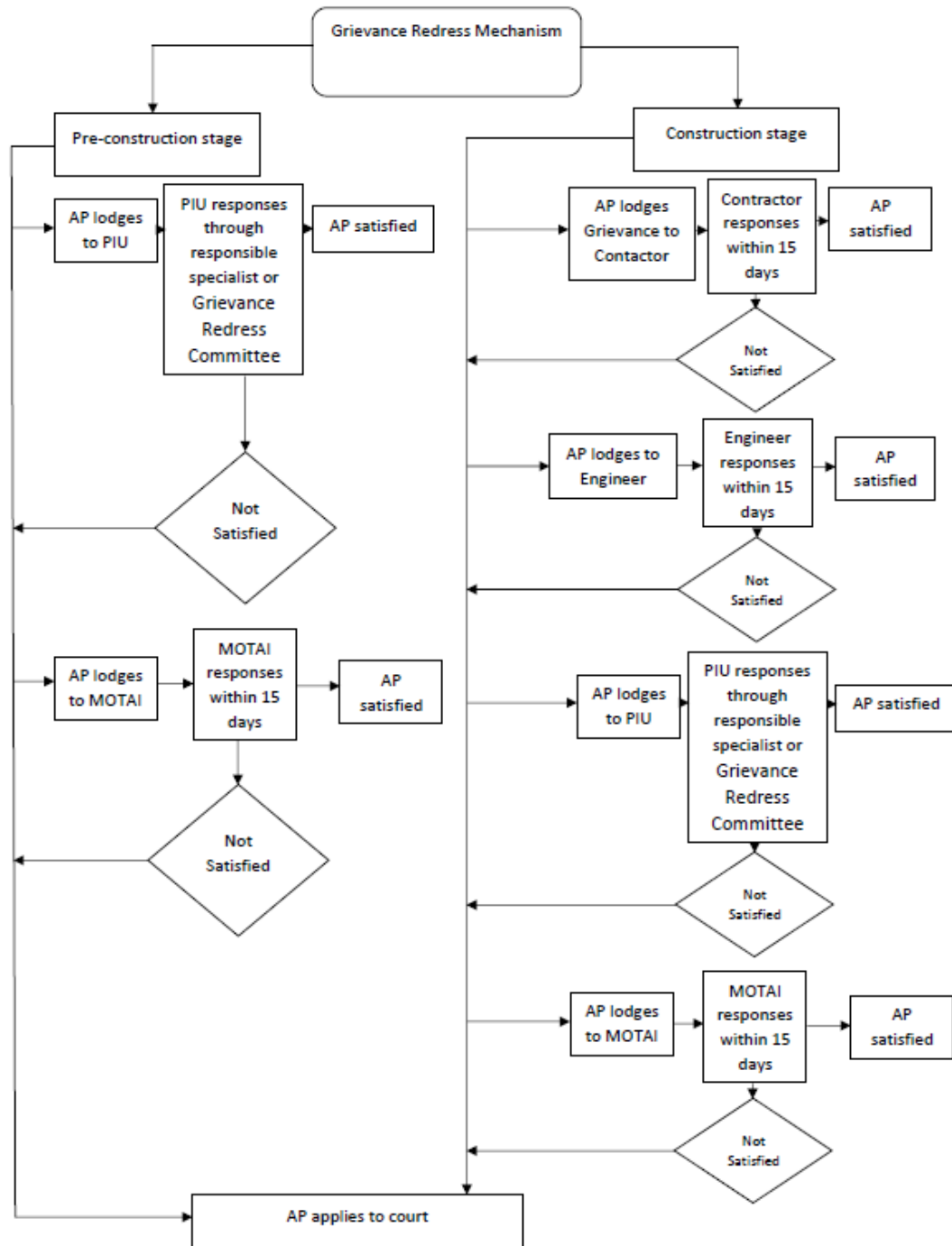


Figure 31: Grievance Redress Mechanism Flow-Chart



The following are the procedural steps to file a complaint, pose an inquiry on matters relating to project implementation, environmental concerns and other issues regarding the Project.

Pre-construction stage:

Step 1. The person affected by the Project could raise their suggestions/concerns/complaints first of all to the RD. The RD receives and resolve/replies the APs' grievances.

If an AP is not satisfied with the response or RD responsible staff needs additional capacity to response the APs' grievance, the Grievance Review Group (GRG) can be formed to ensure comprehensive, equitable and transparent discussion of the case. To establish legitimacy of the GRG to review and judge on the substantive merit of the AP's complaint, the composition of the GRG should be balanced and include an independent observer to ensure the impartiality and transparency of the complaint review process. The following composition of the GRG is proposed:

Members	Position
• Representative of RD	Chairperson
• Representative of safeguards team (RD)	Member
• Representative of Local Government, as relevant	Member
• Certified technical expert, as relevant	Member
• Representative of Engineer/Contractor, as relevant	Member
• Representative of the APs	Member
• Independent party (for example NGO)	Observer

To make for effective complaint processing, the role and responsibilities of each GRG member should be carefully elaborated and explained to them.

Step 2. If AP is not satisfied with RD's decision even after GRG review of the grievance, then s/he can lodge the grievance to the RA Ministry of Territorial Administration and Infrastructure. The MTAI follows Public Administration RA law for registration, revision and resolving the case.

Construction Stage:

Step 1. The person affected by the Project could raise their suggestions/concerns/complaints first of all to the Contractor's dedicated grievance staff that is an attempt will be made to resolve complaints at the local level. In order to maintain transparency and accountability to affected communities and to make information, assistance and grievance resolution services accessible to the Affected Persons, the Contractor will establish the following GRM as a part of the Project's integral GRM:



- (i) AP's could approach Contractor's representative (construction foreman, engineer, social or environmental specialist) on-site and/ or register their suggestion /complain into the grievance register book kept by Contractor at the field office established in the construction camp located nearby the RoW. The template for recording grievance, content and format of the application shall be specified in the Contractor's SEMP and agreed with Engineer.
- (ii) Contractor ensures the provision of contact information (field office location, operating hours, names of responsible contact persons, phone numbers, regular mail and email addresses, etc.) via posters and Project informational boards.

Contractor should immediately inform the Engineer and RD if AP lodged the grievance and should send the copy of written complaint to them. Contractor should implement appropriate mitigation measures to solve the issue and send the written response/reply to the AP with cc Engineer and RD.

Step 2. Should the AP be not satisfied with the Contractors' solution of his/her complain, the further opportunities are available. AP could next apply to the Engineer via lodging the complaint within one month after receiving/not receiving the response from the Contractor.

The incoming suggestions/complains shall be considered and classified into environmental and social/land acquisition and resettlement items. The social/land acquisition and resettlement safeguard related complains shall be handled in the scope of Engineer and RD social specialists.

The environmental specialists of the Engineer in collaboration with the Contractor(s) shall establish an office at the Project site where environmental complaints of Projects' AP regarding EMP and project operations' impacts can be lodged. This Project site office will be used for: supervision of construction, including monitoring of the Contractor's compliance to the EMP to ensure the mitigation measures are timely and properly implemented; disclosing all safeguard documents; and receiving and responding to the comments/feedbacks from the community. The Engineer shall respond to the complaint within 15 days.

Step 3. Should the Engineer fail to satisfy the complaint, AP could apply to RD, MTAI and ADB. The complaint in the Construction stage at the RD level will be preceded with the same scheme as in the pre-construction stage. All the contact information shall be provided by Contractor on posters and on the Project informational board. Contractor shall serve as an entry point in this stage and provide the necessary explanations and assistance in application to the mentioned entities, if needed through the personal contact with AP.

Finally, the AP can always seek attention and interference of the court. However, all the efforts will be made to settle the issues at the Contractor's, the Engineer and RD level. If not possible, attempts will be made to resolve the issues at the MTAI level to avoid/minimize litigation as much as possible.

All complaints regardless of the outcome and solutions will be properly documented and made available for review, monitoring and evaluation purposes.



9. ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan is prepared to ensure compliance with the ADB's environmental safeguard requirements and all applicable laws, regulations and standards for environmental protection in Republic of Armenia. The EMP contains the measures to mitigate and prevent the unwanted effects that may arise during the Project implementation, as well as the monitoring actions to check the compliance of construction works implementation process to the planned mitigation measures through the whole Project cycle: from the engineering design phase, preconstruction, construction through the operation and maintenance periods. The final EMP as an integral part of the final EIA will be included in the tender and contract documents.

On the other hand, the Contractor will determine his construction practices, working methods, schedule and access to the site. To best reflect the changed and modified conditions the Contractor will be required to complete and update the EMP with more detailed site-specific and activity specific mitigation measures and prepare the Site-specific environmental management plans (SEMP) 28 days prior to start the works in the site. The SEMP will be considered as consistent part of Contractor's contractual liabilities.

Contractor will consult with Engineer and decide how many SEMP are needed for the road section area and will prepare the SEMP based on the following outline:

- (i) Boundaries of the site the SEMP is relevant for are defined;
- (ii) Sensitive receptors and environmental values are identified;
- (iii) Site-specific construction activities are specified;
- (iv) The risk of impacts is assessed;
- (v) Environmental management measures are assigned for the impacts that need to be mitigated as a result of risk assessment;
- (vi) SEMP prepared including the sub plans indicated in EMP;
- (vii) Environmental work plans prepared (maps, drawings, etc.).

9.1 MITIGATION

The purpose of the Environmental Management Plan is to guide the Contractor and Engineer in the prevention and mitigation of environmental impacts related to implementation of the construction works, as well as to serve as guidance for the MTAI and other relevant authorities during operation and subsequent maintenance period. The Environmental Management Plan will serve as the basis for the following:

- (i) Management of the Project's potential impacts and their prevention or mitigation;
- (ii) Preparation of SEMP by the Contractor prior to commencement of pre-construction and construction related activities; and



- (iii) Implementation of monitoring program to check compliance with the environmental legislation, regulations and environmental standards.

The Environmental Management Plan summarizes the anticipated environmental impacts. For every identified impact a corresponding mitigation measure is proposed. The mitigation measures will be more specified based on the risk assessment to be conducted during the preparation of the SEMP. The environmental monitoring activities, the entities responsible for carrying out those activities and the estimated costs of implementation are also included.

The SEMP will be prepared by the Contractor based on the specificities of the construction contract and updated upon the need to be adapted to possible changing conditions. It shall be submitted to the Engineer for the review and approval. Any changes or deviations from the SEMP must first be approved by the Engineer.

- (i) According to the recommended Environmental Safeguard Clauses for Civil Works Contracts the Contractor shall undertake the following investigations and activities during the mobilization period:
- (ii) Hire a full time Environmental specialist, and Health and Safety specialist
- (iii) Organize environmental and safety training and orientation for workers
 1. Implement a survey of the initial condition of access roads
 2. Implement the measure on identification and protection of existing community trees that might be damaged by construction activities in accordance with SEMP;
 3. Protection and/or relocation of water mains, sewers, electricity lines and other utilities;
 4. Surveys for collection of baseline data for water quality, air quality (dust), noise and vibration, 21 days prior to commencement of works.
- (iv) Submit for approval by the Engineer 28 days prior to start the works described in the Site-specific Environmental Management Plan.

Beside the above-mentioned Contractor will:

- (i) Provide access to the site and to facilities for the ES.
- (ii) Allow access to the site for any environmental monitoring and inspection at any time requested,
- (iii) Ensure the everyday implementation of the SEMP, including undertaking of regular monitoring, maintenance, reporting, etc.
- (iv) Execute upon work completion, all the work necessary to reinstate all the used areas of the site close to its original condition to the reasonably acceptable level. This will be approved by the Engineer in written certification of reinstatement.

The provisions set out in the EMP will be implemented by the Contractor ES and monitored by the Engineer ES in assistance with RD ES.



The EMP provides general principles and common mitigation measures and includes the following sub-plans:

- Occupational Health and Safety Plan
- Public Consultation and Communications Plan
- Flora & Fauna Protection and Vegetation Clearing Plan
- Utilities Protection and Relocation Plan
- Physical and Cultural Resources Preservation Plan
- Environmental Protection Plan
- Construction Work Camps Plan
- Site Management Plan (Quarry and borrow pit, dumping sites, blasting works sites concrete batching and asphalt plants)
- Tunnels construction sites
- Traffic and Access management Plan
- Emergency Response Plan
- Waste and Material Disposal Plan
- Site Reinstatement, landscaping and Revegetation Plan

9.1.1 Occupational Health, and Safety Plan

The main purpose of this plan is to document all the safeguards requirements of donor organization and Armenian legislation that shall be implemented by the Contractor to ensure environmental and occupational safety and health protection through the Project implementation.

Contractor will hire the health & safety specialist or environmental specialist with responsibility to design and implement the orientation program on the topics detailed in EMP.

Contractor shall take all measures necessary to safeguard the health, safety and welfare of all persons entitled to be on the Site and shall ensure that the Works are carried out in a safe and efficient manner. Occupational health and safety orientation for the whole involved construction personnel shall be organized.

The implementation of the occupational health and safety sub-plan will require environmental, archaeological, and occupational health and safety orientation for all personnel involved in construction work. Members of the staff at all levels have a certain degree of responsibility for environmental protection, archaeology, and professional health and safety. As such, in order to increase the awareness of the construction workforce and develop skills, ensuring that all staff are guided on conservation issues and implementing the EMP to ensure the effectiveness of the EMP.

Requirements for worker to wear personal protective equipment including hard hats, safety boots, high-visibility vests, gloves, eye-glasses and ear defenders and PAH masks or equivalent, are required.



9.1.2 Public Consultation and Communications Plan

The purpose of this subsection is to document all measures the Contractor shall implement to maintain the project information disclosure and the communications with the stakeholders, the project affected people, NGOs and other interested groups about the project in compliance with the safeguards' requirements of donor organization and Armenian legislation.

The subsection aims to raise public awareness and interest and stakeholders' involvement through dissemination of information about program including construction works and related activities' timetable, employment opportunities and benefits of the project.

This subsection is developed with the intention of maintaining the constant communication with stakeholders, members of the community where the project is located and to the general public in whole.

9.1.3 Flora & Fauna Protection and Vegetation Clearing Plan

The purpose of this subsection is to document approach of the Contractor to minimize impacts on flora and fauna and to protect areas that may contain Red Book or endangered species that might be present in the Project area.

The subsection shall be developed to comply with ME policy and the RA Laws on Flora (23.11.2009) and Fauna (03.05.2000), as well as legislative regulations on the use of chemicals for vegetation clearing works.

Mitigating measures are presented in EMP.

9.1.4 Utilities Protection and Relocation Plan

The purpose of this subsection is to document the approach of the Contractor to protect or relocate identified utilities and to manage the protection or relocation of any utilities encountered during the construction works.

Utility designs will be validated by utility owner. The Utilities Protection and Relocation Subsection will be implemented in accordance with Technical Specifications.

Mitigating measures are presented in EMP.

9.1.5 Physical and Cultural Resources (PCR) Preservation Plan

The purpose of this plan is to document the approach of the Contractor and their workers to protect identified archaeological, historical, and cultural sites and monuments and to manage any physical cultural resources that are encountered during the construction works in accordance with Armenian legislative requirements on archaeological and cultural chance finds, as well as to protect the values which are outside but close to the



road alignment.

The Project will not be built in any cultural heritage or archaeological sites designated by UNESCO.

The following accidental discovery protocol will be completed by the contractor. If any potential cultural heritage or archaeological sites are identified:

- (i) Work that might adversely affect that site shall stop immediately;
- (ii) The site shall be reported to the Engineer and RD, who shall ensure that this discovery is reported to MESCS;
- (iii) The area will be demarcated and MESCS will supervise investigation and carry out salvage operations.
- (iv) Such demarcated sites must be inspected to confirm no inadvertent or unreported damage. The frequency of this inspection shall be commensurate with risk and where appropriate must be undertaken without entry to the heritage site.

9.1.6 Environmental Protection Plan

The purpose of this plan is to document the approach of the Contractor and their workers in the implementation of measures to protect the soil, air and irrigation canal from the erosion and sedimentation, dust and other emissions, as well as noise and vibration as a result of the construction activities. The Plan contains mitigation measures to reduce the risk of any impacts to an acceptable level for all the used areas: construction sites, camps, haul roads, quarries, borrow pits, dump sites, etc. Particularly the following aspects are addressed:

- (i) Soil erosion and sediment control;
- (ii) Air pollution and dust control;
- (iii) Water pollution control;
- (iv) Noise & vibration control.

Soil erosion and sediment control plan prescribes the appropriate organization of works on-site to minimize the exposed areas and to avoid soil erosion and origination of sediment-laden runoff,

Plan includes the issues related to topsoil management. Topsoil will be stripped from undisturbed natural landscapes and excavated from embankment areas and borrow sites. Topsoil will be salvaged and temporary stockpiled for further use in cut and fill slopes after completing grading operations. Top soil will be stored for site restoration.

The management measures are developed to minimize potential health and nuisance impacts and air pollution to control dust and gaseous emissions resulting from the construction activities.

The purpose of the noise & vibration control is to minimize and manage the potential impacts of increased



levels of noise & vibration causing health and property risks like nuisances, hearing impairment which can impact both construction workers and the nearby leaving residents.

9.1.7 SEMP's for Construction Camps

The purpose of this plan is to document the approach of the Contractor in the implementation of measures to manage construction camps that will be implemented in or near the right-of-way.

Issues associated with the design, construction, and use of the camps relate both to the potential environmental impacts of the camps, and the need to suitably plan camps to protect the environment avoiding nuisances to adjoining communities and maximize worker health, safety and amenity. The main criteria/principle for the location of facilities for the Contractor's offices, housing of Contractor's personnel, storage of equipment and vehicles is to minimize soil and ground water pollution, and disturbance to nearby residents in order to avoid conflict situation with population and local/central authorities.

9.1.8 SEMP's for quarries, borrow pits, crushing plants, excavated unsuitable material dumping sites, topsoil stockpiling sites, concrete and asphalt batching plants

The purpose of this plan is to document the approach of the Contractor in the implementation of measures to manage the impacts of the construction activities on the quarries, borrow pits, crushing plants, excavated unsuitable material dumping sites, topsoil stockpiling sites, concrete and asphalt batching plants that may be required for the Works. The management measures of this plan have been developed to reduce the potential adverse health effects as well as the concerns caused.

Proposals for quarries, borrow pits, as well as landfills are included in the design package and will be submitted to the Contractor.

9.1.9 Tunnels construction sites

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures to manage the impacts of the construction activities in tunnels. The management measures in this sub-plan have been developed to minimize potential health and nuisance impacts.

9.1.10 Traffic Management Plan

The purpose of this plan is to document the approach of the Contractor in the implementation of measures to manage traffic and access in the construction sites during the construction works. The traffic management plan will be developed by the Contractor as a part of SEMP and will be approved with police, Engineer and agreed with RD, MTAI.



9.1.11 Emergency Response Plan

The purpose of this plan is to document the approach of the Contractor, and their workers for the transportation, handling, use, storage, and disposal of chemicals and in the implementation of measures in the event of spills or accidental releases of hazardous materials and any other likely incident or accidents that may rise during construction works. The implementation of the measures envisaged in the EMP will allow reducing the risk of any impacts up to an acceptable level.

9.1.12 Waste and Material Management Plan

The purpose of this Plan is to document the approach of the Contractor, and their workers in the implementation of measures for the management and disposal of wastes and spoil materials produced during construction and for the management of contaminated soil, in case the construction activities interfere with presumably contaminated soil.

The key waste management philosophy that is applied in this plan is based on the following hierarchy of waste management approaches (highest to lowest priority):

- (i) Avoid waste generation and interference with contaminated soil;
- (ii) Minimize waste generation and interference with contaminated soil;
- (iii) Reuse as much waste as practical;
- (iv) Recycle as much waste as practical; and
- (v) Dispose of any remaining waste and displaced contaminated soil in an environmentally suitable manner in locations assigned by the relevant authorities. The management of waste, spoil materials and contaminated soil according to the aforementioned principles using proper collection, segregation, storage, disposal and education/training methods will ensure the low level of risk associated with waste generation and contaminated soil manipulation. The proposed mitigation measures are listed in EMP and could be completed by Contractor in SEMP.

According to the mentioned principles, the management of waste, spoiled materials and contaminated soil, together with the appropriate accommodation, segregation by type, storage, accumulation and application of educational / training methods, will ensure a low level of risk of waste generation and contact with contaminated soil. Proposed mitigation measures are listed in the EMP and must be completed by the Contractor in the SEMP.

9.1.13 Site Reinstatement, Landscaping, and Re-vegetation Plan

The purpose of this plan is to document an approach of the Contractor, and their workers in the



implementation of site cleaning and restoration including restoration, landscaping, and re-vegetation measures as part of the construction works.

9.1.14 Post-construction phase (Operation and maintenance)

During the Defect liability period Contractor will be responsible for the environmental safeguard's compliance to ADB SPS and Armenian legislation for the time period during which Contractor is implementing defect correcting works on-site. For the rest time period during the whole Defect liability period and the following operation period environmental compliance to the requirements of Armenian legislation will be ensured by MTAI.

9.2 MONITORING

Monitoring within the EMP includes baseline monitoring data collection and regular environmental monitoring.

The baseline data on water quality was collected by the Engineer during the preparation of the EIA, which will be carried out or approved 21 days prior to the commencement of works by the Contractor. The contractor should also collect the initial data on noise and vibration.

Dust, water, noise monitoring plan will be developed by Contractor and agreed with Engineer for further regular monitoring with clear indication of location of measurement points, schedule of measurements and thresholds relevant for each measurement point for the comparative analysis. The thresholds for the further regular monitoring will be set based on baseline data and Armenian regulation standards. The costs of baseline data survey will be included in Contractor's budget.

The regular environmental monitoring contains the planned activities that will guide the Contractor to check and/or compare the effectiveness of the mitigation measures for prevention and control of the negative impacts of the Project. It is also used for measurements and comparative analysis of different parameters whether or not the environmental standards and indicators are maintained or exceeded so immediate and appropriate action can be taken. Environmental monitoring can also point and determine the efficacy of mitigation measures to control unwanted impacts of the Project. It will be monitored by the Engineer in determining if the recommended mitigation measures are being implemented effectively. Environmental monitoring results will be documented to record the signs of adverse impacts which are detected in order to undertake the corrective actions at the earliest time practicable. Where monitoring results do not meet the environmental performance indicators, action taken will also be recorded.

Monitoring shall be implemented through the monitoring site visits of environmental specialists of all Project levels. The site visits shall be carried out in accordance with the formal monitoring schedule: Contractor-weekly, Engineer - monthly. The details of environmental monitoring tasks are described in EMP.



9.3 IMPLEMENTATION ARRANGEMENT

Implementation schedule and responsible entities of implementation are provided in the EMP.

9.3.1 Environmental Staffing

Environmental Specialists will be involved at Engineer and Contractor level. The capacity built to ensure compliance of project activities with ADB safeguard policy and Armenian legislation, as well as tasks and responsibilities of environmental units and specialists involved in the Project are also provided in the EMP.

9.3.2 Responsibilities, roles, tasks and frequencies related to monitoring

Regarding the implementation, the supervision and the monitoring of the EMP, responsibilities, roles, tasks and frequencies are as follow:

- (i) The Contractor environmental specialist has the following responsibilities, roles and tasks:
 - Contractor's supervising team and environmental specialist implement the environmental mitigation measures and their related monitoring activities on a daily basis;
 - Environmental specialist monitors baseline data surveys as required in the Technical Specifications and the Environmental Protection Plan;
 - Environmental specialist carries on site's visits and inspections on a weekly basis;
 - Environmental specialist documents monitoring activities and results in a weekly environmental report;
 - In case of inadequate monitoring results, Environmental specialist identifies the necessary corrective actions through a Corrective Action Plan as soon as possible;
 - In cases of accidents (fire, explosion, oil spill, bitumen overflow, etc.), the Contractor must notify the Engineer immediately. Initial notification might be verbal, but must be followed by a written report within 24 hours after the incident or accident happened;
 - Environmental specialist prepares monthly environmental report as part of Contractor's monthly progress report
 - Environmental specialist carries out site visits during the defects liability period and provides a site status report.

- (ii) The Engineer environmental specialist has the following responsibilities, roles and tasks:
 - Supervise, inspect and coordinate, on a daily, weekly and monthly basis, the tasks of the environmental specialist of the Contractor and the Contractor's construction activities;
 - Inspect sites that the Contractor are intending to use for construction camp (s), facilities,



storage, parking, waste dumping, etc. prior the start of operation, prepares the reports on the findings of inspection and submits to the Engineer for approval, as soon as this information is available;

- Review Corrective Action Plans provided by the Contractor;
- Inspect and supervise the implementation of corrective actions by the contractor to ensure their effectiveness soon after their implementation;
- Review the Contractor's weekly monitoring reports to check on proper the data and information of the environmental monitoring activities;
- Review and approve the documents submitted by Contractor based on consultation with RD, updated EMP, report outlines and templates, etc.;
- Handling the complaints of GRM
- Review Contractors site status report during the defects liability period;
- Prepare a monthly progress report based on contractor monthly progress report, including environmental safeguards and monitoring implementation;
- Prepare quarterly/semi-annual reports as well as completion report for submission to the RD.

The Environmental and Mining Inspectorate (EMI) have the authority to inspect the Project's compliance with the environmental protection principles and relevant regulations in accordance with Armenian environmental legislation.

9.3.3 Awareness raising and environmental training

The Contractor shall be responsible to arrange general orientation session about project activities and environmental awareness. This session shall focus on the responsibilities for all people/workers working on site about the protection of the environment and the safe handling of social issues during construction period in accordance with ADB SPS (2009), Armenian environmental legislation and EIA and EMP.

A training need assessment will be identified for proper delivery of EMP at field level. Session shall include but not limited to: minimizing waste at source, respecting and protecting wildlife at site, proper handling of the waste, workers' safety measures during work and emergency preparedness in case of incidents, etc. A separate session for nearby impacted communities shall also be arranged to inform on the GRM and to protect people from any incidents during construction period. A special session for truck and machinery drivers shall also be included.

9.4 COSTS AND SOURCES OF FUNDING

Environmental cost as a separate unit to be paid will be included in the BoQ. In addition, environmental costs (oversight, research, training, public relations, reporting) will also be included in the Engineer's budget as required by the proposal.



The costs of the EMP-relevant sub-plans are part of the direct costs of implementing the Project. Thus, the costs are estimated by the Contractor as the marginal costs of the three general phases of the Project: the pre-construction, construction and post-construction phases. Indicative costs are presented in the EMP. The summary table of expenses is presented below.

Table 20: Rated amounts and EMP funding source

Type of activitie	Cost (US dollar)	Sources of funding
Implementation of environmental mitigation measures and monitoring	1 533 843	Researches are also included in the budget
Strengthening EMP management	180 000	Contractor 90,000 USD is included in total construction costs Engineer 90,000 USD is included in the budget
Raise the awareness of Project staff and other workers	15 750	Contractor Included in total construction costs
Total: US dollar	1 729 593	
Expenditures: US dollar (13.3%)	1 959 629	
Profit (11%) – US dollar	2 175 188	
Total US dollar (including VAT, 20%)	2 610 225	

9.5 REPORTING

The environmental safeguards compliance of the Project shall be regularly reported on all project implementation levels: Contractor, Engineer, RD / MTAI and donor organization.

The following environmental reports shall be submitted by the Contractor:

- (i) Weekly Environmental Reports – The results and findings from the environmental monitoring activities will be documented in specially developed by Contractor and approved by Engineer monitoring check list. The weekly monitoring report shall include the environmental performance indicator and assessment of the effectiveness of the mitigation measures.



- (ii) Monthly Progress Report- summary environmental report shall be submitted as part of the Contractor's Monthly Progress Report. Monthly reports shall be analytical and provide explanations for anomalies, non-compliance and problems encountered.

The Reports shall comprehensively include all relevant aspects in implementing the mitigation measures of the EMP and SEMP (e.g., what type of mitigation, purpose and object(s), site/location, materials and activities involved, others specify) compliance to any environmental regulations and requirements such as training/orientation, permits, license, etc. undertaken during the period covered by the report. The outline of the reports will be agreed with the Engineer and RD and will contain the following parameters to be monitored:

- (i) Work sites;
- (ii) Work Site safety – Site workers and surrounding communities;
- (iii) Material and Waste management and disposal; including hazardous waste;
- (iv) Contractor's facilities and equipment;
- (v) Quarries, borrow pits, excavated material dumping sites, topsoil stockpiling sites, asphalt and concrete batching plants, stone crushing machineries' sites;
- (vi) Public communication and grievances.

In cases of accidents, (fire, explosion, oil spill and bitumen overflow, etc.), the Contractor must notify the Engineer immediately. Initial notification may be verbal and shall be followed by a written report within 24 hours when the incident or accident happened.

The Engineer submits to RD monthly and bi-annual monitoring reports on environmental safeguards. RD will submit bi-annual environmental safeguards report to donor organization. The bi-annual reports shall be disclosed on the RD websites.



10. CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS

The southern part of the RA Corridor, the Kajaran-Agarak road section, was inspected by the ADB Rapid Environmental Assessment (REA) checklist to determine its environmental category. Based on the REA checklist, the Project is located in a protected area - Zangezur Biosphere Complex, in particularly a special biodiversity protection area of Arevik National Park. The program is classified in "A" group.

According to the RA environmental laws, in case of construction (or reconstruction) of road with four or more lanes or widening of roads with no more than two lanes to obtain four or more lanes, if the section has a continuous length of 10 km and more, it is necessary to carry out environmental expertise.

During the preparation of the EIA report, air quality, noise and vibration levels were studied to update the environmental baseline data. In addition, a number of studies have been conducted to identify biodiversity (including specially protected areas) and the monuments, which have historical and cultural value in the affected area.

Potential adverse effects (inconvenience / disturbance due to dust, noise, traffic & traffic changes) that are likely to affect nearby communities, as well as impact on flora and fauna are related to the construction works will have temporary impacts and can be reduced by following the environmental management plan developed for the work site, providing appropriate oversight, and implementing the necessary mitigation measures set out in the EMP in a timely manner.

Besides, improving the existing road will facilitate traffic, increase economic opportunities by ensuring:

- job opportunities during construction and operation,
- a cultural infrastructure that will improve the movement of people and goods and will contribute to the development of this region of Armenia,
- free access to tourist and cultural places, especially "Arevik" national park,
- easy laying of communication routes required for the service of "Arevik" national park,
- an institution that will provide more business opportunities in the study corridor and will improve the economic cycle.

The main benefits of the program are **economical**.

10.2 RECOMMENDATIONS

The Contractor shall prepare based on the EMP and submit for approval by the Engineer, the Site-specific Environmental Management Plans (SEMP) with detailed operating environmental management and



monitoring measures during the mobilization period, prior to the start of construction works, during the entire length of the construction activities and during the defect's liability period.

The Engineer shall monitor and supervise the implementation of mitigation measures by the Contractor as specified in the EMP and issue non-compliance notice if they are not properly implemented in a timely manner. The Engineer may stop all relevant works (at the Contractor's cost) until the requirements of the EIA and EMP have been fulfilled and rectified to the Engineer's satisfaction.

The compliance of construction activities to the donor organization safeguards requirements and to Armenian legislation shall be checked through regular monitoring carried out by the Contractor, Engineer and RD.

The Contractor's environmental specialist together with Engineer's environmental specialist will survey the location of trees from not-acquired lands and bushes most likely to be damaged by the construction activities and propose methods to prevent their lost. All trees and bushes that can be avoided by construction activities but are close to work sites should be protected. All other trees and bushes that cannot be preserved will be replanted at a ratio of 1:6. The planting of those trees and bushes for replacement will be performed in locations with suitable soil conditions. Local species will be used. The newly planted trees should be maintained for 3 years by the Contractor.



11.ANNEXES

ANNEX 1: RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST

Country/Project Title:

Armenia / **Tranche 4 North South Road Corridor Investment Project**

Sector Division:

Instructions:

- (i) The Project implementation team completes this checklist to support the process of environmental classification. It should be enclosed with the environmental classification form and be submitted to the Department of Environment and Warranty, for the approval of the Director and the Chief Compliance Officer.
- (ii) Issues related to the environment serve as the basis for this checklist. In order to make sure that all the social aspects have been considered properly, the following issues related to the ADB should be taken into consideration: a) checklists on mandatory resettlement and indigineous people, b) poverty mitigation measures, c) staff's guidelines for organizing and participating in public hearings, and d) checklist on gender-related issues.
- (iii) Answer questions, considering that it is a case "with no mitigation". The objective is to discover the possible impact. Use the "Notes" section to discuss any expected mitigating activity.

Table 21: Rapid environmental assessment (REA) checklist

Questions	Yes	No	Remarks
A. Project location Is the project site located in or near one of the following environmentally sensitive areas?			
<ul style="list-style-type: none"> ▪ Cultural heritage site 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Preliminary research has uncovered several archaeological sites near the project. Archaeological sites will be explored and relevant measures will be offered for their proper protection.



Questions	Yes	No	Remarks
<ul style="list-style-type: none"> Protected area 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The planned road plan crosses the “Zangezur” Biosphere Reserve (Arevik National Park) in some sections. The total crossing area is about 4 km in several sections. Appropriate mitigation measures should be developed to reduce the impact of the project.
<ul style="list-style-type: none"> Wetland 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not found. Located far from the project plan.
<ul style="list-style-type: none"> Mangrove 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<ul style="list-style-type: none"> Estuarine 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<ul style="list-style-type: none"> Buffer zone of protected area 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	N/A
<ul style="list-style-type: none"> Special area for protecting biodiversity 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not found
B. Possible effects on the environment Is the Project ...?			
<ul style="list-style-type: none"> Will pass along areas of historical/cultural significance, the green areas will be modified through using road slopes, charges, mineral products, and quarries 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The route passes through several archaeological sites. This project will include measures complying with the requirements set by the RA Ministry of Education, Science, Culture and Sport - to study the area properly and close it. These measures will be described in the Preliminary Study of the Environment (PSE) and Environmental Impact Assessment (EIA), and details will be provided in the Environmental Management Plan (EMP).
<ul style="list-style-type: none"> Will be a threat to sensitive or protected areas 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A section of approximately four km passes through the area of “Zangezur” Biosphere Complex (“Arevik” National Park). This project will include measures complying with the requirements set by the RA Ministry of Environment and the Eurasian Development Bank (EDB)/Asian Development Bank (ADB). The measures will be described in EIA, and details will be provided in the EMP.
<ul style="list-style-type: none"> Will alter the hydrology of surface waters, as a result of which the number of sediments will increase in rivers caused by the soil erosion impact from the construction site. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The mitigating measures are described in the EIA report, and more details are provided in the EMP section.



Questions	Yes	No	Remarks
<ul style="list-style-type: none"> Deterioration of surface water quality caused by sludge flows and the work camps - household waste and the chemicals used during the construction. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>Possible impact if the camps are poorly managed.</p> <p>The mitigating measures are described in the EIA report, and more details are provided in the EMP section.</p>
<ul style="list-style-type: none"> Increase in the level of pollution in the area caused by explosion of the rocks, mineral products, charge works, and the chemicals used for asphalt development. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> (i) Rock explosions and drilling will be necessary for removing unstable slopes, for the purpose of installing protection against rock fragments. (ii) Rock explosions and drilling will be necessary for building the tunnels, which may impact dust formation, however, those sections are far from sensitive areas. (iii) Rock explosions and the asphalt plant will have a possible impact on dust formation. <p>The mitigating measures are described in the EIA report, and more details are presented in the EMP section.</p>
<ul style="list-style-type: none"> Will result in workplace health and safety risks and vulnerability, connected with the physical, chemical and biological hazards of the construction works and operation. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> (i) Adverse effects (air, noise) imposed on the workers and the adjacent sensitive receptors caused from the construction process. (ii) Possible impact on the road operation caused during operation works - increase in traffic intensity, although it was mentioned that the surface improvement and vertical and horizontal layouts will contribute to the mitigation of possible emissions and road traffic accidents. <p>The mitigation measures are described in the EIA report, and more details are provided in the EMP section.</p>



Questions	Yes	No	Remarks
<ul style="list-style-type: none"> Noise and vibrations caused by explosions and other construction works 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> (i) Rock explosions and drilling will be necessary for the construction of tunnels and the road. (ii) The cutting of the existing steep rock materials and the installment of slope protection equipment have a negative impact; however, those areas are located far from sensitive receptors. (iii) There are some residential buildings located in certain sections. The construction work will have adverse effect on the residential areas; however, those effects will be brought to a minimal through the EMP.
<ul style="list-style-type: none"> Displacement or mandatory resettlement of people 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Included in the land alienation and resettlement program (LARP)
<ul style="list-style-type: none"> Displacement or mandatory resettlement of people residing in the alienation zone 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No changes to be made compared to the current situation.
<ul style="list-style-type: none"> Disproportionate impact on the poor, women, children, indigenous people, or other vulnerable groups. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No impact is anticipated.
<ul style="list-style-type: none"> Other concerns of social nature which relate to the inconveniences of living conditions in the project areas, that may cause issues with upper respiratory tract and stress 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not clarified.
<ul style="list-style-type: none"> Hazardous conditions for driving vehicles in the intersection between the construction area and the existing old roads. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The work should be organized in accordance with all the requirements in order to avoid any hazardous conditions during the construction.
<ul style="list-style-type: none"> Insufficient sanitary hygiene conditions, solid waste disposal in the construction camps and sites, transmission of infectious diseases (such as sexually transmitted infections and HIV/AIDS) from the workers to the local population is possible. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<p>Possible impact if the camps are poorly managed and no training is organized for the personnel.</p> <p>The mitigation measures are described in the EIA report, and more details are provided in the EMP section.</p>
<ul style="list-style-type: none"> Formation of temporary infection sources which are transmitted through mosquitoes and rodents. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not applicable.



Questions	Yes	No	Remarks
<ul style="list-style-type: none"> Accident hazards connected with the increase of traffic that results in accidental leaks of toxic substances. 	<input type="checkbox"/>	<input checked="" type="checkbox"/>	It is anticipated that with the newly constructed road, the traffic intensity will increase, the route and the surface, as well as the signage system will be improved, a more efficient and better transportation service will be available, and the overall number of accidents will go down.
<ul style="list-style-type: none"> Increase of noise and air pollution levels due to the increased traffic 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	(i) During the construction, the traffic movement will increase as a result of the construction traffic. (ii) During the construction, it is anticipated that the traffic intensity will increase, the route and the surface, as well as the signage system will be improved, a more efficient and better transportation service will be available, and the overall number of accidents will go down.
<ul style="list-style-type: none"> Increase in water pollution risks caused by oil, lubricants and fuel leakage, as well as leakage of other substances caused by the cars passing by the new road. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Possible negative impact during the construction operations, such as leakage. During the operation, it is anticipated that the traffic intensity will increase, the route and the surface, as well as the signage system will be improved, a more efficient and better transportation service will be available, and the overall number of accidents will go down.
<ul style="list-style-type: none"> Social conflicts in the case of hiring workers from other regions or countries. 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The possibility for local workforce's employment and the development of the field of trade may promote local economy and relieve the tension.
<ul style="list-style-type: none"> A big flow of incoming population during the project construction works and the operation phase, which will contribute to the overload of social infrastructures (such as water supply and drainage systems) 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The construction camps and sites should have a separate system of water supply, as well as a system of solid and liquid waste disposal.
<ul style="list-style-type: none"> Community health and safety risks connected with the use of explosives, fuel and other chemicals used during the construction and operation and/or their removal, transfer and storage 	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A negative impact may be posed caused by the use, storage and transfer of construction materials used during the construction works. The mitigation means through a proper management of the construction site are described in the EIA report, and more details are provided in the EMP section.



Questions	Yes	No	Remarks
<ul style="list-style-type: none">Community safety risks due to both accidental and natural hazards, in particular, when the structural elements or components of the project are accessible for the members of the affected community, or when their failure may cause damage for the community after the construction works and operation of the project.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none">(i) During the construction the Contractor should make sure that it is safe in the construction site, and that the communities are isolated from the construction operations.(ii) During the operation, the project will improve the road safety of a number of local communities, by giving them access to the new road with respective furnishing, i.e., signs, divider zone, roadsides, etc.



ANNEX 2: ENVIRONMENTAL MANAGEMENT PLAN OF TRANCHE 4 - 45 KM KAJARAN TO AGARAK ROAD SECTION

The Environmental Management Plan (EMP) provides the set of mitigation and monitoring measures to be undertaken during project implementation in order to avoid, reduce or mitigate the adverse environmental impacts. It presents the identified potential impacts and their locations and occurrences, proposed mitigation measures, the entities responsible for mitigation and their monitoring activities including the estimated costs.

The EMP describes how the mitigation and other measures to enhance the benefits of environmental protection will be implemented and monitored. It explains how the measures will be set up and managed, who will be responsible to implement them, when and where they will be implemented and by whom monitored. The following elements are described in the EMP:

- (i) Project Activities addressed in the EMP;
- (ii) Potential environmental impacts (including impacts on archaeological resources);
- (iii) Mitigation measures during pre-construction, construction and operation phases of this Project;
- (iv) Monitoring activities during pre-construction, construction and operation phases of this Project;
- (v) Responsibilities of various entities in the implementation of mitigation and monitoring measures; and
- (vi) Indicative costs of environmental management and mitigation



Table 22: Environmental and Social Management Plan: Mitigation

Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
PRE-CONSTRUCTION PHASE				
<p>1. Baseline monitoring surveys (air quality, water quality and noise)</p> <p>2. Construction planning for archaeological excavations/ preservation of historical, cultural and natural monuments</p> <p>3. Protection and relocation / transportation of public utilities</p>	<p>Lack of baseline monitoring data during the construction phase</p> <p>Impacts on flora, fauna and archaeological, historical and cultural monuments</p> <p>Interruptions of services due to utilities relocation / transportation</p>	<p>1. Develop EMP and baseline monitoring survey results to reflect detailed design for inclusion in tender and contract documents</p> <p>2. Include special demands in tender and contract documents</p>	<p>Project Consultant</p> <p>Develop an EMP to include relevant provisions in the tender and contract documents.</p> <p>RD</p> <p>Evaluate bids and sign the contracts</p> <p>EDB</p> <p>No objections to EMP</p>	<p>The costs of these activities are included in the budget of the consultant 's design</p>
<p>EMP requirements are not taken into</p>	<p>1. Develop technical specifications based on mitigation measures set</p>	<p>Project Consultant</p> <p>Develop specifications and update tender and contract documents, including relevant</p>	<p>The cost is included in the consultant's</p>	<p>EMP requirements are not taken</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
<p>account in the detailed design, which leads to adverse environmental impacts during project construction and operation phases.</p>	<p>out in the EMP, as well as include environmental provisions in the special terms of tender and contract documents.</p>	<p>environmental provisions</p> <p><u>RD</u> Revise / Consider tender and contract documents</p> <p><u>EDB</u> Be informed about the results of the RD monitoring</p>	<p>design budget</p>	<p>into account in the detailed design, which leads to adverse environmental impacts during project construction and operation.</p>
<p>CONSTRUCTION PHASE</p>				
	<p>Non-compliance of the contractor's activities with the EMP leads to insufficient environmental control and deterioration of the environment</p>	<p>1. The Contractor hires a Health, Safety, Environmental Specialist (HSE) to oversee environmental issues and mitigation measures.</p> <p>2. Provide environmental, health and safety training for all staff</p> <p>➤ (For more information, see sub-plans below)</p>	<p><u>Contractor</u> Provide specialist (s) and organize trainings for staff</p> <p><u>Engineer</u> Provide specialist (s) and organize trainings for staff</p> <p>Monitor the Contractor, construction workers, environmental</p>	<p><u>Contractor</u> The cost of one part-time health, safety and environment (HSE) specialist for a 60-month construction period is estimated 90,000 USD.</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
			parameters and report results to RD RD Submit non-compliance notifications	<p>Engineer</p> <p>The cost of one full-time safety health professional for a 60-month construction period is estimated at \$ 90,000 USD.</p> <p>The cost of one day of introductory course on health, safety and environment is \$ 50 for 300 construction workers, plus the tutor's 10-day fee of \$ 75 per day.</p> <p>As a result: \$ 15,750 USD.</p> <p>Engineer</p> <p>The cost of</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
				one day of health, safety and environmental training is 500 USD. 15 lessons in 60 months are valued 7,500 USD.
	<p>Deterioration of the environment</p> <p>Damage caused by dust, air pollution, noise and vibration</p> <p>For the safety and health of the workers and the residents of the community</p> <p>Hazards (including alienation zone, drilling points, unloading sites, construction camps)</p>	<p>During the mobilization period, prepare and submit SEMP, including the following environmental management sub-plans:</p> <ol style="list-style-type: none"> 1. Occupational health and safety plan 2. Public Consultation and Communication Plan 3. Flora and fauna protection and vegetation cleaning plan 4. Utilities maintenance and relocation plan 5. Physical and cultural resources conservation plan 6. Environmental management plan 7. Construction camp plan 8. Work site management plan (quarry and open pit, waste dumping sites, blasting sites, concrete drilling and asphalt plants) 9. Tunnel construction sites 10. Traffic and access management plan 11. Emergency Response Plan 12. Waste and material removal plan 13. Site rehabilitation, landscaping and re-vegetation plan <p>i) Sub-plans should be based on the EIA report, tender, contract documents, and international best practices in environmental management, as described below.</p>	<p><u>Contractor</u> Prepare and implement</p> <p><u>Engineer</u> Observe, approve and monitor the process</p> <p><u>RD</u> Supervise Contractor and Engineer</p>	<p>The cost of these plans is calculated separately for each construction plan described below.</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>1. Occupational health and safety plan</p>		
	<p>Lack of information of the new recruited staff on impacts and mitigation measures led to insufficient environmental controls and environmental degradation</p>	<p>Provide training to all staff on hygiene, and Health & Safety and professional orientation by the following topics:</p> <ul style="list-style-type: none"> ➤ General rules and regulations to be followed on the construction site and camps ➤ Construction activity-specific rules and regulations including working on bridges, in tunnels, working with electrical tools, digging pits, etc. ➤ General health and safety awareness program for educating construction workers on sexually transmitted diseases and HIV/AIDS <ul style="list-style-type: none"> • Illegal trafficking: workers should be made aware that trafficking of humans, wildlife, endangered species, and illegal substances through the road corridor will not be tolerated and be advised of a progressive penalty scheme up to and including dismissal <p>2. Take all permissible precautions (tape blocking, checkpoints, etc.) to prevent unauthorized access to the construction site</p> <p>Blasting. The training should include a component of explosion safety (if blasting is planned) components. Topics should include:</p> <ol style="list-style-type: none"> a. Public meetings to present the concept of safety during blasting b. Posted signs indicating blasting hours c. Signals before blasting 	<p>Contractor</p> <p>Implement the plan and prepare an orientation plan</p> <p>Engineer</p> <p>Consider and approve the plan developed by the Contractor.</p> <p>Assist and monitor implementation process.</p> <p>Review accident records</p> <p>RD</p> <p>Review the plan and assist the Engineer</p>	<p>The cost of developing, implementing and managing this plan by the Contractor’s Health and Safety Specialist is already included in Section 3.</p> <p>For 300 employees in personal protective equipment: 150 USD each.</p> <p>As a result, 45,000 USD</p> <p>Courses on health risks and illegal trafficking are</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>d. Use of blasting mattresses</p> <p>e. Proper use and storage of explosives materials</p> <p>3. Eliminate hazardous practices on the construction site, as well as all hazardous tools</p> <p>4. Existence of fire extinguisher, easily accessible for all useable cars in all parts of the construction site</p> <p>5. Regular medical health examinations of employees. The Contractor may hire or contract with the required medical professionals (doctors)</p> <p>6. Easily accessible first aid kits in all useable cars in all parts of the construction site</p> <p>7. Provide proper uniform taking into account weather conditions and other relevant PPE for staff and other workers. Application of incentives and fines for the use of protective equipment (PPE)</p> <p>8. Reporting to Supervising Engineer and Relevant Governments in case of health and safety accidents</p>		<p>listed in Section 3.</p>
		<p>2. Public consultation and communication plan</p>		
<p>Public consultation, awareness raising and grievance</p>	<p>Lack of information and understanding by communities and affected parties about the planned works activities and schedule of implementation can lead to frustration and complaints, which in</p>	<p>(i) Develop an application form for public complains and suggestions and receive Engineer’s approval.</p> <p>(ii) Install posters or project informational boards with relevant information for the Public: field office location, operating hours, names of responsible contact persons, “hot line” phone numbers, postal address and email addresses, etc.</p> <p>(iii) Keep a grievance register book available at the field office or in any other easily accessible location for affected people.</p> <p>(iv) Maintain a register of complaints (name, description of the problem, incoming date, response date, further follow-up action and resolution status).</p>	<p>Contractor</p> <p>Prepare and implement the plan</p> <p>The health and safety specialist hired by the contractor implements the awareness and</p>	<p>Included in total construction cost, and in the budgets of Engineer and RD</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	turn could result in delays for the Project.	(v) Allocate personal responsible for dealing with issues raised by the Public and affected people. (vi) Organize regular meetings with community members to discuss newly arisen issues if any. (vii) Make sure that complaints and suggestions prompt forwarded to the Engineer from the Contractor, or to RD from the Engineer depends on needed level to solve raised issues.	grievance redress plan <u>Engineer</u> Review and approve the plan developed by the Contractor. Monitor the implementation <u>RD</u> Supervise the Engineer	
3. Flora and fauna protection and vegetation cleaning plan				
Earthworks and other construction works	Disturbance and degradation of flora and fauna habitat, especially Red Book species Vegetation clearing is harmful to the natural habitat of the fauna	1. Undertake a survey to identify all trees and bushes which are located close to construction site and could be damaged by construction works 2. On-site measures to protect trees and shrubs that may be affected (make them easily recognizable to workers, traffic control, waste disposal, etc.) 3. Notify the Engineer and relevant organizations and obtain approvals prior to start right-of-way clearing (Trees and bushes removal)	<u>Contractor</u> Prepare and implement the plan Hire a local fauna and flora expert to assess the prevalence of Red Book species in the project area to reduce the impact	The cost of developing, implementing and managing this plan by the Contractor's HSE specialist is already recorded in



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>4. Strictly perform vegetation cutting and clearing works in accordance with Technical Specification</p> <p>5. Stop the works in the area where unknown species are encountered and clarify whether these are Red book listed, rare or endangered species</p> <p>To include posters in construction camps that illustrates the Red Book species likely to be found in various areas of the project</p> <p>Develop a progressive penalty plan to discourage the hunting and consuming of wildlife.</p> <p>6. Inform the Engineer environmental specialist for future actions in case rare species are discovered</p> <p>7. Inform the Engineer in case of an injured animal is found</p> <p>8. Undertake the vegetation removal and site clearing preferably during late autumn and/or winter</p> <p>9. Develop a register of cut trees and bushes and make it available for review</p> <p>10. Use only pesticides that are not listed in the Government decree N293 of 17 March 2005 and exclude the use of POP containing chemicals for vegetation clearance purposes</p> <p>11. Ensure that workers are using PPE when using pesticides or other vegetation clearing chemicals</p> <p>12. Transport cut vegetation to approved waste dump within 2 days</p> <p>13. Temporarily heap cut vegetation in designated location within the Project right-of-way before transportation to waste dump</p> <p>14. Avoid burning of cut vegetation</p>	<p>on conservation of those species, to make recommendations, and to monitor their results.</p> <p>The specialist will prepare a project for planting or relocating trees as a result of negotiations with forestry representatives</p> <p>Engineer</p> <p>Review and approve the plan developed by the Contractor and monitor the implementation process</p> <p>Present the results on a monthly basis</p> <p>RD</p> <p>Supervise the Engineer</p>	<p>Section 3.</p> <p>The cost of a local expert on Fauna & Flora hiring for 20 days, each day of calculating the 75 US dollars, amounted to 1,500 USD</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>3. For protection of fauna the following actions should be undertaken: the future status of the invertebrate’s fauna biodiversity there is need for further implement of the continuous monitoring.</p> <p><u>Amphibians and reptiles</u></p> <ul style="list-style-type: none"> • During the construction where a big number of species are gathered specialist should gather the individuals and release them in more suitable and safe territories. The gathering of species must be carried out before the launch of heavy construction machinery • Provide underground passageways and fences (the exact places must be clarified) in some sections of the road <p><u>Birds</u></p> <ul style="list-style-type: none"> • Provide fencing usually equipped with deterrent devices (reflectors, warning lights, horns, etc.) • Suspend works causing intense physical impacts (noise, vibration, explosions, light effects, etc.) in periods of breeding, hatching, etc. (If necessary, consult with experts) For this reason, in forested territory clearance should be carried out, usually in winter. • Register cases of finding inhabited nesting sites (masonry or chicks), make the transfer of nests prior construction works with participation of expert <p><u>Mammals</u></p> <ul style="list-style-type: none"> • The Specialist should take out encountered animals from construction site • Provide passages for small mammals along the road section for giving them a chance to pass the road safely • Road should be protected with a wall for avoiding the entrance of animals 		
		<p>4. Utilities maintenance and relocation plan</p>		



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Utilities protection and relocation	Disruption of services provided by utilities causes impact on affected people	<ol style="list-style-type: none">1. Implement the protection and relocation of utilities in accordance with Technical Specifications2. Identify with utility owner the exact location of services and if necessary, carry out trial pits3. Schedule and implement the works to minimize the temporary disturbance of services4. Notify the potentially affected people prior to the start of works that disturbance to services may occur5. Protect or relocate utilities discovered during construction works that were not identified during the Design stage6. Contractor will reimburse the costs of found or damaged utilities	<p><u>Contractor</u> Survey utilities and prepare plan prior to construction Liaise with local representatives and service providers Hire approved contractors</p> <p><u>Engineer</u> Consider and approve the plan developed by the Contractor Assist with liaison with local representatives and service providers</p> <p><u>RD</u> Monitor the Engineer</p>	The cost of maintaining or relocating utilities cannot be calculated as an environmental mitigation measure.
		5. Physical and cultural resources conservation plan		



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
<p>Earthworks, construction of tunnels and bridges at immediate vicinities of archaeological sites, historical, cultural and natural monuments</p>	<p>Damage to archaeological, historical, cultural and natural monuments</p>	<ol style="list-style-type: none"> 1. Protect sites of known archaeological, historical and cultural resources by the placement of suitable fencing and barriers to avoid potential adverse impacts to historic and cultural resources 2. Ban dumping and disposal of waste, garbage and construction debris in the protection areas of monuments 3. During construction phase exempt areas outside the construction site from heavy equipment 4. Prohibit the use of land at archeological sites for construction 5. Prepare an Archaeological Excavation Work Plan (EMAP) for the excavated sites 6. Carry out archeological excavations in accordance with the EMAP before the start of construction 7. Implement chance-find procedure in case of finding of archaeological artefacts: <ul style="list-style-type: none"> • stop construction works immediately; • notify the Engineer, RD; • isolate the site, document and photograph the find and the area immediately around it; • inform the Ministry of Education, Science, Culture and Sport and hire an experienced and qualified archaeologist to determine whether and how the chance-find should be preserved; • when advised and as directed by RD, ensure proper archaeological excavation in coordination with the concerned government agencies; • obtain necessary approvals from MESCS to proceed with construction works where archaeological excavations are finished and site is free from archaeological findings. 	<p><u>Contractor</u></p> <p>Engage archaeologist to organize and monitor excavations, prepare and implement chance find procedure</p> <p>Start construction only after the completion of the archeological survey and receiving the final approval from the Ministry of Education, Science, Culture and Sport</p> <p><u>Engineer</u></p> <p>Prepare EMAP Modify the road design, including detailed archaeological survey recommendations,</p>	<p>Included in the total construction cost, calculated as a maximum of 0.5%.</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
			<p>if any</p> <p>Review the recommendations and monitor the implementation process</p> <p>Assist with liaison with concerned government agencies</p> <p>RD</p> <p>Supervise the Engineer and follow the procedure</p>	
		6. Environmental management plan		
<p>10. Earthworks</p> <p>Transportation of materials</p> <p>Road works</p> <p>Other construction</p>	<p>Erosion</p> <p>Increased levels of air pollution due to dust emissions from cars</p> <p>Increased noise and vibration due to</p>	<p>The Environmental Protection Plan is developed as part of the SEMP.</p> <p>The place and frequency of regular monitoring of dust, air, water, noise and vibration are indicated below:</p> <p>Soil erosion and sedimentation control</p> <p>1. Implement the erosion control in accordance with Technical Specifications</p>	<p>Contractor</p> <p>Prepare environmental management plan, collect baseline data on dust, air, noise and vibration,</p>	<p>The following costs are for environmental protection:</p> <p>a) The cost of treating</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
works	construction works	<p>2. Preserve existing soil layer where practicable</p> <p>3. Provide temporary cover such as fast-growing grass species in areas where soil layer is removed and the ground is exposed for a long period</p> <p>4. Take the necessary measures to prevent soil erosion and to ensure the stability of the slopes</p> <p>5. Perform the topsoil stripping and stockpiling in accordance with Armenian legislation and Technical Specifications</p> <p>6. Manage arable soil in such a way as to preserve its chemical and biological properties. Use it again for planting trees, shrubs and other landscaping</p> <p>7. Seed grass on surfaces where topsoil is exposed to erosion risks (steep slopes, high embankments, etc.).</p> <p>8. Seed grass as soon as possible to avoid long period during which the ground is barren.</p> <p><i>Air pollution and dust control</i></p> <p>1. Minimize dust emissions through regular water spraying of construction works surfaces</p> <p>2. Minimize the amount of excavated material held on site and cover all materials wherever possible to prevent dust emissions</p> <p>3. Regulate the speed level of vehicles and machinery to minimize dust emissions</p> <p>4. Use electricity or battery power where possible (or practical) for hand tools rather than diesel</p> <p>5. Avoid the use of generators powered by diesel or petrol where practicable</p> <p>6. Provide workers and vehicle drivers with dust protective masks and ensure they are using it</p> <p>7. Regularly collect baseline data on the level of dust emissions in the most sensitive areas and collect data from the same location to describe changes in air quality</p>	<p>prepare dust, air, water, noise and vibration level control plan</p> <p>Coordinate with local community leaders the placement of excess soil and topsoil</p> <p>Rent a local water cannon to prevent dust emissions</p> <p>Present the results on a monthly basis</p> <p><u>Engineer</u></p> <p>Review and approve the plan developed by the Contractor and monitor the implementation process</p> <p><u>RD</u></p> <p>Supervise the Engineer and follow the procedure</p>	<p>construction waste (before it is discharged into rivers) is estimated at 35,000 USD</p> <p>b) The cost of installing the oil separator is estimated at 26,000 USD</p> <p>c) The cost of approximately 53,200 m³ of topsoil extraction,</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>Water quality and sediment control</p> <ol style="list-style-type: none"> 1. Schedule construction work near all rivers to carry out low-water works (June 1 to September 30) 2. Install tools and other dust-generating equipment as far away from river basins as possible 3. Regularly check run off from construction camps, waste disposal areas and construction work areas, effluent from quarries, crushing plant, and concrete batching plant (if any), as well as regular inspections of employees' drinking water quality 3. Build separators for oil and other materials to strictly control the outflow of solid and liquid waste into rivers 4. Prevent untreated runoff from all construction sites 5. Specify location of regular monitoring of water quality; locate monitoring points approximately 50 m upstream and 50 m downstream from the construction works site 6. Prevent leakage from all construction sites, including construction camps, quarries, crushers, concrete drilling plants, waste dumps, etc. 7. Treat water flows from construction so that sediments can be cleared before flowing into rivers 8. Install netting or sheeting beneath the bridge during construction to catch any materials that may be dropped 9. Construct oil- and other substances-separators to strictly control the discharge of them during construction works into the water bodies 10. Regularly inspect, repair or maintain drainage structures to avoid sedimentation, especially after rain 11. Clean the pits and drainage pipes from sediments coming from construction sites 		<p>storage, and reuse, at a cost of \$ 2 per m³, is 106,400 USD</p> <p>d) In order to prevent dust emissions, the cost of watering on barren land and construction trucks for 20 months (600 days) for 60 months of the construc</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>12. Carry out concrete filling, sealing of ditches, application of waterproof paint or protective systems, wetting, etc. during dry weather to avoid contamination of water bodies</p> <p>13 Wash all used machines and recharge at a safe distance from water bodies</p> <p>14. Install oil collectors at each drain point</p> <p>15. Install a pressure pipe or similar restraints on all facilities to prevent contamination in the case of accidental leakage</p> <p>16. Maintain sufficient water flow in the rivers to ensure the free movement of fish</p> <p>17. Build a dam along the rivers at a distance of 10 m from the watercourse to control the outflow of extraction particles from the construction site</p> <p>18. Install sediment collection devices on estuaries to reduce the risk of sludge leakage into water bodies</p> <p>Noise and vibration control</p> <p>1. Comply with construction activities related noise & vibration national legislation</p> <p>2. Avoid locating construction activities, camps, machinery and equipment near sensitive receptors such as forests, protected areas, poorly insulated houses, schools, and other public and residual areas</p> <p>3. Schedule noisy activities towards the middle of the day whenever it is practicable</p> <p>4. Collect baseline data on vibration at sensitive receptors (poorly constructed structures, historical, cultural and natural monuments) and regularly collect data on vibration from the same location</p> <p>5. Ensure that all equipment and vehicles are equipped with proper silencers for minimizing noise generation at source</p> <p>6. Ensure workers and drivers are provided with appropriate PPE including ear protective equipment</p>		<p>tion work schedule is 60,000 USD per day if it costs 100 USD per day.</p> <p>e) The cost of hiring a specialist to conduct monthly measurements of surface water, air, and noise levels is estimated at 4,000 USD per month. For a total</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		7. Use equipment or machinery with lower vibration level in vicinity of poorly constructed structures, historical, cultural and natural monuments where vibration can be cause of cracks		period of 60 months, it is 240,000 USD
		7. Construction camp plan		
11. Housing for staff, equipment, storage of materials, machinery and parking	<p>Harmful effects on the health of the workforce</p> <p>Inconveniences caused to the nearby population of construction site</p> <p>Soil compaction of temporary parking areas</p> <p>Ստորգետնյա ջրերի աղտոտում</p> <p>Environmental pollution</p>	<ol style="list-style-type: none"> 1. Obtain Engineer’s confirmation of construction camp location before establishing it 2. Locate camps as far away from residential areas as possible so as not to disturb people living near the Project 3. Do not place construction sites, vehicles, equipment, parking areas and other fixtures on harmless / protected landscapes and in vegetated areas 4. Take measures to ensure that construction workers and other staff members have access to recreation facilities (toilets, hand sinks, showers, etc.), canteens and offices 5. Wastewater will be collected and transferred to appropriate wastewater processing places 6. Collect garbage and place in designated and approved landfills 7. Ensure construction camp security and cleanliness 8. Restore natural surfaces that have condensed after the removal of construction equipment 	<p><u>Contractor</u> Prepare and implement the plan</p> <p><u>Engineer</u> Consider and approve the plan by overseeing the implementation process</p> <p><u>RD</u> Supervise the Engineer and Follow the procedure</p>	<p>The cost of developing, implementing and supervising this plan by the Contractor is already included in the total construction costs.</p> <p>The implementation of this plan will be overseen by the Contractor’s environmenta</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
				I, health and safety specialist. Costs are included in Section 3.
		8. Work site management plan (quarry and open pit, waste dumping sites, blasting sites, concrete drilling and asphalt plants)		
12. Operation of quarries, borrow pits, dumping sites, concrete and asphalt batching plants	<p>Inconveniences caused by noise and dust</p> <p>Impact on environmental, historical, cultural and natural monuments by improper spoil disposal</p> <p>Losses to aesthetics</p> <p>Disruption of local living conditions and means of communication</p> <p>Presence of and interaction with the construction work force</p> <p>Pressure on natural</p>	<ol style="list-style-type: none"> 1. Develop this plan before the start of site work 2. Give preference to existing quarries, concrete and asphalt batching plants, instead of opening new ones 3. Obtain all permits and approvals from relevant authorities and RD before using the appropriate areas for the operation of quarries, open pits, dump sites, concrete drilling and asphalt plants 4. In case of need for new concrete and asphalt plants, possible affected parties will be identified and mitigation measures will be developed based on risk assessment 5. In case of opening new asphalt concrete drilling plants by the Contractor, they should be as far away from residential areas as possible so as not to cause concern to the local population. 6. Avoid installing concrete and asphalt batching plants on undisturbed natural landscape and on surfaces covered with vegetation 7. Explosives will be stored, disposed of and used in accordance with applicable laws 8. Controlled and slow implementation of blasting operations will reduce the harmful effects 	<p>Contractor Prepare and implement the plan</p> <p>Engineer Consider and approve the plan by overseeing the implementation process</p> <p>RD Supervise the Engineer and Follow the procedure</p>	<p>The cost of developing, implementing and supervising this plan by the Contractor is already included in the total construction costs.</p> <p>The implementation of this plan will be overseen by the Contractor's environmental</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	resources and services provided by humans Other direct impacts such as erosion and sedimentation, road damage, spoil and other waste disposal, noise and dust generation	<p>9. Residents of the area around will be notified before blasting activities begin</p> <p>10. The flagmans will be placed near the construction site</p> <p>11. Apply all the mitigation measures as described above to minimize impact on air quality, water quality, flora and fauna, utilities, and population of nearby residential areas</p> <p>12. Prepare traffic management plan for access and operation of vehicles</p> <p>13. Prepare waste management plan to address all the issues related to waste generation</p> <p>14. Prepare and introduce the methodology of quarries, open pits, dump sites, concrete drilling and asphalt plants, as well as blasting works for the approval of the RD</p>		I, health and safety specialist. Costs are included in Section 3
		9. Tunnel construction sites		
13. Construction of 9 tunnels	Impact on environmental, historical, cultural and natural monuments by improper spoil disposal Blast impact on community, safety concern Impact on wildlife	<p>Develop a plan before construction begins</p> <p>Reuse spoils as embankment or sub grade or in other facilities of the project</p> <p>Consult with local government and community as to reuse spoils for urban or community infrastructure construction</p> <p>Dispose properly remaining spoils in the identified spoils' sites after getting approval/agreements from local governing bodies</p> <p>Geological test drilling will be carried out to make predictions</p> <p>Use sedimentation and filtration ponds at tunnel construction sites to treat wastewater before discharge to nearby water bodies</p> <p>Tunnel cladding must be done in a timely and proper manner</p>	<p>Contractor Prepare and implement the plan</p> <p>Engineer Consider and approve the plan by overseeing the implementation process</p> <p>RD Supervise the Engineer and Follow</p>	Included in total construction costs.



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	Disturbance of rock formations, rock movements and fragmentations	<p>Sedimentation and treatment reservoirs should be used in the construction area of the tunnel for wastewater processing before discharging into the nearby side canals.</p> <p>Strictly follow blasting operations, methodology and safety rules</p> <p>Notify local communities before blasting</p> <p>If necessary, carry out a preliminary inspection of the safety of nearby buildings to determine the method of blasting & drilling</p> <p>In the most sensitive areas, every perimeter and millisecond blasting methods should be used to minimize impact on wildlife.</p> <p>The best time to carry out blasting work is during the day, in order to reduce the impact on the wildlife</p>	the procedure	
		10. Traffic and access management plan		
14. Vehicle movements on and off construction site	<p>Traffic issues</p> <p>Hazards and safety issues related to traffic</p> <p>Damage to roads by construction heavy equipment and vehicles</p> <p>Dust, noise and vibration</p> <p>Dirt and mud carried onto public roads</p>	<p>1. Organize the movement of vehicles and machinery in a manner creating least interference to the flow of traffic</p> <p>2. Ensure 24h per day access of public to houses, shops, business, etc.</p> <p>Vehicle management on site and off site</p> <p>1. Obtain approvals from governmental organizations and local self-governing bodies for the construction traffic routes</p> <p>2. Locate entrances and exits of the construction sites so that they cause minimal disturbance to general traffic and that they do not compromise public safety</p> <p>3. Undertake a pre-construction condition survey of local roads and affected properties</p>	<p>Contractor</p> <p>Prepare and implement the plan</p> <p>Engineer</p> <p>Consider and approve the plan by overseeing the implementation process</p> <p>RD</p> <p>Supervise the Engineer and Follow</p>	The cost of developing, implementing and supervising this plan by the Contractor is already included in the total construction costs.



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>4. Train drivers on TMP and safety</p> <p>5. Locate parking of machinery in designated sites only</p> <p>6. Implement an appropriate construction signage scheme including direction signs, markings, traffic signals, lighting, clearly visible solid barriers to channel traffic, flagmen and maintenance of diversions</p> <p>7. Install speed limit signs</p> <p>8. Schedule the movement of vehicles to avoid rush hours where practicable</p> <p>9. Ensure that the vehicles are provided with and are using tarpaulin to cover loads when carrying sand, soil, spoil and waste material and driving outside of construction sites</p> <p>10. Ensure that vehicles are equipped with exhaust attenuators, silencers</p> <p>11 Check that vehicles are regularly maintained to prevent fuel and oil leakages and to meet national regulative requirements</p> <p>12. Stop the operation of leaking machinery and replace them with those in good condition</p> <p>13. Provide measures on cleaning the tires (gravelled surfaces and vehicle wash facilities at site provided with suitable runoff protection) before the leaving of the construction site to prevent the construction dirt and mud be spread out</p> <p>14. Check regularly dirt and mud accumulation coming from the construction sites on adjacent roads. Sweep and clean whenever is required and when it is safe to do so</p> <p>15. Set speed limits on construction sites to prevent any safety issue and for controlling dust emission</p>	<p>the procedure</p>	<p>The implementation of this plan will be overseen by the Contractor’s environmental, health and safety specialist. Costs are included in Section 3</p> <p>The cost of irrigation on dirt roads and ways are already included in Section 6.</p>
		<p>11. Emergency Response Plan</p>		



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
<p>15. Handling hazardous substances and other emergency situations (incidents, accidents, etc.)</p>	<p>Leakage or spillage of diesel fuel, oil or other toxic substances entering soil and groundwater</p>	<ol style="list-style-type: none"> 1. Provide to the Engineer the list of substances which contain hazardous elements e.g., diesel, waste oil, paints, herbicides, etc. 2. Develop and implement procedures to ensure safe handling and storage of hazardous substances. Keep the material safety data sheets, posters with emergency response procedures, and clean-up tools readily available on site and train the workers on their proper use 3. Store equipment for cleaning up spillages properly to ensure it is easily available when needed 4. Designate an Emergency Response Team (ERT) response-ready at any time 5. Ensure that the ERT receives emergency response training 6. Ensure that the ERT and all personnel handling chemicals and hazardous substances receive hazard and risk management training 7. Clean the area of spillage immediately to prevent potential contamination of soil and groundwater using a dedicated absorbent material. Remove the pollutant, together with the contaminated soil and the absorbent materials and discard to a site approved by ME. 8. Manage hazardous wastes in accordance with Armenian regulation 9. Use chemicals, hazardous substances, and fuel only when necessary. Those substances should be stored on site, within a covered, secure and naturally ventilated area with an impervious floor and impervious bund around it. The bund should have a capacity of at least 150% of the capacity of the largest tank 10. Locate the storage area away from drainage lines and danger areas 	<p><u>Contractor</u> Prepare and implement the plan</p> <p>Dispose of hazardous materials as directed by the Ministry of Environment</p> <p><u>Engineer</u> Consider and approve the plan by overseeing the implementation process</p> <p><u>RD</u> Ensure cooperation with the Ministry of Environment</p> <p>Supervise the Engineer and Follow the procedure</p>	<p>The cost of developing, implementing and supervising this plan by the Contractor is already included in the total construction costs.</p> <p>The implementation of this plan will be overseen by the Contractor's environmental, health and safety specialist. Costs are included in Section 3</p> <p>The cost of</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		11. Provide all construction sites with emergency contact information, responsible persons & safety officer name(s), telephone numbers, etc. 12. Develop an accident report form with the Engineer 13. Inform the Engineer on any accidents (incidents) immediately and report by filling in the accident report form.		irrigation on dirt roads and ways are already included in Section 6. The cost of training 40 members of the Emergency Response Team is 50 USD per day, plus the teacher's 3-day fee of 75 USD is estimated 6,225 USD.
		12. Waste and material removal plan		
16. All site activities construction sites and construction camps	Spoil disposed in inappropriate locations Waste and materials pollutants entering drainage system and/or infiltrating groundwater	1. Develop Waste Management Plan /WMP/ as the part of the SEMP 2. Record the type of construction waste and quantity in the waste register at the beginning of each month 3. Organize a training program on waste management for the Contractor's Personnel	Contractor Prepare and implement the plan Dispose of hazardous materials as directed by the	The cost of developing, implementing and supervising this plan by the Contractor is



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
	<p>Potential safety hazards related to construction materials not cleared from the construction site</p>	<p>4. Remove construction waste, garbage and rubbish from the site regularly to avoid dust and long-term accumulation of the litter. The frequency of removal as a threshold for monitoring purposes will be specified by Contractor in the SEMP</p> <p>5. Store wastewater in airtight tanks for proper handling</p> <p>6. Classify non-fit and other construction waste by type: solid, liquid, hazardous, hazardous, as well as recyclable</p> <p>7. Apply to the Waste Research Centre SNCO in ME for categorization of the construction wastes, as well as for obtaining licenses when needed</p> <p>8. Obtain all permits for waste disposal and dispose only in permitted sites</p> <p>9. Obtain hazardous waste disposal permits from the Ministry of Environment</p> <p>10. Apply to the Engineer for waste disposal dump sites investigation and approval</p> <p>11. Install special containers for garbage collection which are timely emptied. Construction waste should be removed from the site daily or even more frequently to avoid any stockpiles that may become impediment for the traffic. No waste should be left on site by the end of the working day. Facilities for rubbish and garbage accumulation and removal are installed and emptied regularly</p> <p>12. Maintain a waste register at the construction site, for all types of waste (concrete, asphalt, soil and sand) and appoint responsible staff</p> <p>13. Transport waste, contaminated soil and materials in accordance with the Traffic Management Plan</p> <p>14. Spoil should be disposed of in locations approved by governmental and local authorities</p> <p>15. Collect wastewater in special reservoirs and properly treat it from oil and fuel before entering the water bodies</p>	<p>Ministry of Environment</p> <p>Engineer</p> <p>Consider and approve the plan by overseeing the implementation process</p> <p>RD</p> <p>Ensure cooperation with the Ministry of Environment</p> <p>Supervise the Engineer and Follow the procedure</p>	<p>already included in the total construction costs.</p> <p>The implementation of this plan will be overseen by the Contractor's environmental, health and safety specialist. Costs are included in Section 3</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		16. Collect excessive amounts of oil, lubricants and fuel to avoid spillages and to dispose of in proper disposal sites. Solvents and volatile materials shall be handled according to the procedures prescribed by EMP, Armenian legislative orders and best international practices		
		13. Site rehabilitation, landscaping and re-vegetation plan		
17. Site re-instatement of all areas Re-vegetation, and landscaping	Construction waste and materials are not removed and are left on construction sites Constructor's camps and facilities, dump sites, borrow pit and quarries, concrete and asphalt plant areas are not restored properly Cleared vegetation and trees are not fully recompensed by vegetation restoration works	<ol style="list-style-type: none"> 1. Develop the Site Reinstatement, Landscaping, and Re-vegetation Plan as a part of SEMP 2. Remove all construction-related materials and equipment from the site including machinery, wastes, unused materials, fencing etc. 3. Reinststate natural drainage and other utilities 4. Restore the soil layer and loosen soil caused by heavy machinery 5. Clean the construction site from the litter and traces of oil and fuel spillages (if any) 6. Rebuild construction roads (roads intended for transportation of construction materials and equipment) to their previous condition 7. Use the checklist prepared by the Engineer 8. Perform the vegetation restoration works according to the Landscaping plans specifically developed for each site 9. Requirements for re-vegetation work which includes planting, maintenance and monitoring to ensure high survival rate and fast growth of trees, bushes and other plants are presented hereunder. Requirements will be provided in the landscape design or instructed by the Engineer <ul style="list-style-type: none"> • Replant trees, shrubs and plants according to the landscaping project provided by the Engineer and agreements with adjacent community leaders, "Hayantar" SNCO and "Zangezur Biosphere Reserve" (Arevik National Park) • Plant tree / shrub seedlings in a ratio of 1: 2, ie 2 seedlings for each tree or shrub cut in the 	<p>Contractor Provide a landscaping project, hire an approved contractor for landscaping to implement the plan, cooperate with the responsible bodies of forestry and "Zangezur" State Reserve</p> <p>Engineer Review and approve the plan developed by the Contractor. Monitor the survival status of trees and other plants during construction work and defect elimination period</p>	<p>Expenses are related only to trees and shrubs outside the alienation zone.</p> <p>Expenditure on trees, shrubs, and crops within the Project's impact zone will be reimbursed under the Project's LARP.</p> <p>According to the research, 19366 trees will be cut down during the</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
		<p>project alienation area, except for privately owned trees, which are compensated in accordance with the LARP. In addition, Red Book plants should be planted in a ratio of 1:10. As a result of the investigation, 19366 trees (approximately 185659 bushes) were endangered due to the widening of the road and construction works, therefore 38732 trees and 371318 bushes should be planted, ensuring the ratio of existing trees and shrubs affected by the Project. The number of red book plants is 15.</p> <p>Maintain seedlings of trees and shrubs during construction, as well as other plants. After the defect elimination period, the responsibility for the care of the trees should be transferred to the local communities, "Hayantar" SNCO, "Zangezur" Biosphere Reserve, depending on the area where the trees / shrubs were planted (note that the defect elimination period will continue in the initial period)</p>	<p>RD Supervise the Engineer and monitor the survival status of trees and other plants</p>	<p>construction works and approximately 42257 (185659 m² shrubs, average 1 shrub - 4-5 m²) shrub.</p> <p>Planting of 38732 tree saplings (20 USD each) and planting 84514 shrub saplings (20 USD each) is estimated at a total of 943,668 USD</p> <p>Red book plants are replanted in a ratio of 1:10:</p> <p><i>Trifolium grandiflorum</i> Schreb., VU</p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
				<p><i>B1 - 3 individuals, 300 USD</i></p> <p><i>Honeysuckle (Cousinia meghrica Takht.), EN B1 - 3 individuals, 300 USD</i></p> <p><i>Jurinea elegant (Jurinea elegans (Stev.) DC.), EN B 1–2 individuals, 200 USD</i></p> <p><i>Sausage plant (Platanus orientalis L.), EN B 1 - 5 individuals, 1250 USD</i></p> <p><i>Pear mixed</i></p>



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
				<p><i>(Pyrus complexa Rubtzov), EN B 1- 1 individual, 250 USD</i></p> <p><i>Pyrus raddeana Woronow, EN B 1- 1 individual, 250 USD</i></p>
POST-CONSTRUCTION PHASE (OPERATION AND MAINTENANCE)				
Defect correction works	All the impacts identified in Construction Phase	1. Activity-specific mitigation measures envisaged in the Construction Phase	Contractor Implements the EMP and SEMP for the time period the Contractor has implemented defect correction works	Cost of long-term monitoring by the Contractor cannot be



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
			and provides environmental safeguard reports <u>MTAI / RD</u> Implements works on road maintenance ensuring cleanliness and safety	evaluated at the moment.
19. Water outflow from the bridge to Loradzor, Vorotan and Geghi rivers	Road pollutants are discharged into the rivers	1. Maintain an oil separator facility at bridge drainage outlets to prevent discharge of pollutants from road into rivers	<u>Contractor</u> Defects must be repaired during the repair period <u>MTAI / RD</u> Maintain the facility during the rest of the defect liability period and during operation phase	Cost of long-term monitoring by the MTAI cannot be evaluated at the moment.



Project Activities	Potential Environmental Impacts	Proposed Mitigation Measures	Responsible Entities	Indicative cost of mitigation (US\$)
Re-vegetation	Vegetation does grow as expected	1. Monitor the growth and health state of trees, bushes, other plants and lawn. Replace any death damaged or unhealthy specimens. Reseed incorrectly grown surfaces of lawn.	<u>Contractor</u> Defects must be repaired during the repair period <u>MTAI / RD</u> Preserve trees, shrubs, lawns during operation, or hand over to "Hayantar" SNCO	Cost of long-term monitoring by the MTAI and "Hayantar" SNCO cannot be evaluated at the moment.
21. Environmental audit		1. Will be implemented and presented to the ADB with a post-construction environmental audit.	<u>MTAI / RD</u>	The cost of the environmental audit will be included in the budget of the RD.



Table 23: Environmental and Social Management Plan: Monitoring

Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
CONSTRUCTION PHASE						
(To be updated by the Contractor with the assistance of the Engineer Environment Specialist prior to begin construction and thereafter, as required)						
1. Work opportunities for local workers, unskilled workers and women	Involve local, unskilled workers and women	All Construction sites (Including Right of way, Borrow pits, Dump sites, Construction camps)	Documentation review including number of effective job postings intended to local workers, unskilled workers and women by Contractor	Number of local, unskilled workers and women that have been hired on the project.	<p><u>Contractor</u></p> <p>Development of a hiring program for local, unskilled workers and women</p> <p><u>Engineer</u></p> <p>The environmental specialist is reviewing the Contractor's recruitment plan</p> <p>The cost of the control work will be included in the Engineer's budget</p>	<p>It should be clarified when the Contractor plans to recruit staff</p> <p>Review in the ramp-up phase of construction activities</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
					RD Supervise the Engineer	
2. Occupational Health and Safety	<p>Trainings on Health and safety</p> <p>Uniform and safety equipment provided</p>	All construction sites	<p>Inspection of Occupational Health and Safety Documentation</p> <p>Inspection of construction sites</p> <p>Inspection of Register of incidents and/or accidents</p> <p>Ask questions random workers</p>	<p>List of attendees to the training session is available</p> <p>Reports of Construction sites' inspections are available</p> <p>Register books describing incidents and/or accidents are available</p>	<p>Contractor</p> <p>Development and implementation of the Occupational Health & Safety Plan</p> <p>The cost of the monitoring process will be included in the Contractor's budget</p> <p>Engineer</p> <p>The environmental specialist monitors the occupational health and safety plan.</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p>	<p>According to regular formal monitoring schedule</p> <p>The Plan must be developed and validated prior the commencement of construction activities</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
					Supervise the Engineer	
3. Public Consultation and Communication	<p>Public consultations in affected communities prior to construction works</p> <p>Signboards with general information about construction</p> <p>Complaint's register book</p>	Contractor's field office, and all construction sites	<p>Documentation review</p> <p>Construction sites' inspections</p> <p>Public consultations</p> <p>Review of the register of complaints</p>	<p>The Public Consultation and Communication Plan is available at all sites</p> <p>The grievance redress mechanism was implemented following the requirements, procedures, and indicators described in Section 8 of the EIA</p> <p>Procedures for communicating, complaints and grievance redress mechanism with local residents and stakeholders developed,</p> <p>Signboards and notices posted around construction sites</p>	<p>Contractor</p> <p>Development and management of public consultation and communication plan</p> <p>Engineer</p> <p>The environmental specialist reviews and oversees the public consultation and communication plan</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p> <p>Supervise the Engineer</p>	<p>According to regular formal monitoring schedule</p> <p>The plan should be developed as an integral part of the SEMP and approved prior to the commencement of construction works.</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
4. Protection of Flora and Fauna, Vegetation Clearing	Vegetation clearing is minimized to the extent possible Vegetation near Works' sites is protected	All construction sites	Review of all documentation related to vegetation clearing Construction sites' inspections	There is a plan for the protection of flora and fauna, as well as the cleaning of vegetation Mitigation measures are put in place for protecting Fauna or Flora species discovered just before construction activities commence The register of cut trees and bushes is available	<u>Contractor</u> Development and implementation of the Flora & Fauna Protection and Vegetation Clearing Plan as the part of the SEMP The cost of monitoring should be included in the Contractor's budget <u>Engineer</u> Reviewing and supervising the Flora & Fauna Protection and Vegetation Clearing Plan by environmental specialist The cost of the control work will be included in the Engineer's budget <u>RD</u>	According to regular formal monitoring schedule The Plan must be developed and validated prior the commencement of construction activities



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
					Supervise the Engineer	
5. Utilities Protection and Relocation	<p>Cases of disruption of services impacting consumers</p> <p>Re-located of utilities, where needed</p>	All construction sites	<p>Review of all documentation related to Utilities Protection and Relocation</p> <p>Construction site(s) inspections</p> <p>Review register of complaints</p>	<p>The Utilities Protection and Relocation Plan is available</p> <p>Number and severity of complaints logged in the Register of Complaints</p> <p>Utilities discovered during construction works did not lead to interruption of service to end users / consumers</p>	<p>Contractor</p> <p>Development and monitors of the Utilities Protection and Relocation Plan as the part of the SEMP</p> <p>The cost of monitoring should be included in the Contractor's budget</p> <p>Engineer</p> <p>The environmental specialist review and supervise the Utilities Protection and Relocation Plan</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p> <p>Supervise the Engineer</p>	<p>According to regular formal monitoring schedule</p> <p>The Plan must be developed and validated prior the commencement of construction activities</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
6. Environmental protection	<p>Spread of erosion and weeds on barren soils</p> <p>Sediment leakage</p> <p>Topsoil storage</p> <p>Emissions of dust and other air pollutants</p> <p>Noise and vibration level</p> <p>Water pollution</p>	<p>All construction sites</p> <p>Sensitivity to dust, water, noise and vibration</p> <p>The most sensitive objects located about 50 m or closer to the construction site</p> <p>The areas to be monitored are specified in the regular periodic table of dust, water, noise and</p>	<p>Visual inspection of construction sites</p> <p>Review of the register of complaints</p> <p>Instrumental measurements</p> <p>Instrumental measurements Of noise</p> <p>Instrumental measurements of vibration</p> <p>Instrumental measurements of water quality</p>	<p>Environmental management plan (dust, water, noise and vibration) is available</p> <p>Number and severity of complaints logged in the Register of Complaints</p> <p>Visits to erosion-sensitive sites, sites subject to sedimentation by drainage, as well as vegetation sites</p> <p>Measurements of dust emissions, noise and vibration in the most sensitive areas at a distance of about 50 m from the construction site</p> <p>In case of operation of asphalt or concrete plant, the measuring points are located near the nearest residential and public buildings.</p> <p>The level of dust emissions corresponds to the standards of Armenian norms (RA Law on Atmospheric Air Protection: 1994, amended in 2007).</p> <p>The level of noise vibration corresponds to the standards of Armenian norms (RA Decision N ° 138, 2002)</p>	<p>Contractor Development and monitoring of Environmental Management Plan</p> <p>The cost of monitoring should be included in the Contractor's budget</p> <p>Engineer The environmental specialist reviews and manages the Environmental Management Plan and oversee its implementation</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>ՃԴ Supervise the Engineer</p>	<p>According to the schedule of dust, water, noise and vibration level monitoring plan specified by the Contractor</p> <p>The plan must be developed and approved by the RD before construction can begin</p> <p>The baseline data will be collected 21 days before the start of construction work</p> <p>Measurements of dust emissions at least once every two weeks and more often in dry weather, depending on complaints received</p> <p>Noise and vibration</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
		vibration baseline data				measurements at least every two weeks, or based on complaints received
7. Construction of camps	Location, layout and management of construction camps Security fence	Boundary of construction camps, as well as construction works	Documentation review Construction camps' visits	The Construction Camp's Plan is available. The location and the layout of the Construction Camp(s) comply with location and layout agreed by authorities Number and severity of complaints logged in the Register of Complaints Security fence properly set and intact	<u>Contractor</u> Development and monitoring of Construction Camp's Plan The cost of monitoring should be included in the Contractor's budget <u>Engineer</u> The environmental specialist reviews and manages the Construction Camps Plan The cost of the control work will be included in the Engineer's budget <u>RD</u>	According to regular formal monitoring schedule The Plan must be developed and validated prior the commencement of construction activities



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
					Supervise the Engineer	
8. Quarries, borrow pits, concrete and asphalt batching plants, excavated unsuitable material dumping and topsoil stockpiling sites	Location, layout and management of Quarries, borrow pits, concrete and asphalt batching plants, excavated unsuitable material dumping and topsoil stockpiling sites Disturbances to affected communities	Quarries, borrow pits, concrete and asphalt batching plants, excavated unsuitable material dumping and topsoil stockpiling sites	Documentation review Site visits	Workplace management plan is available The layout of the construction site (s) meets the requirements of the plan specifications Number and severity of complaints logged in the Register of Complaints	Contractor Development and monitoring of workplace management plan The cost of monitoring should be included in the Contractor's budget Engineer The environmental specialist reviews and manages the workplace management plan The cost of the control work will be included in the Engineer's budget RD Supervise the Engineer	According to regular formal monitoring schedule The Plan must be developed and validated prior the commencement of construction activities
9. Traffic and accesses management	Itineraries and accesses locations	Roads use for transportation of	Documentation review Sites' visits	The Traffic Management Plan (TMP) is available for review	Contractor	According to regular formal



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
	Nuisances and safety issues related to communities Damages to road and utilities (mainly drainage)	equipment, and material Accesses to the construction site		Itineraries and access locations and layouts complies with specifications of the Plan Number and severity of complaints logged in the Register of Complaints	Development and monitoring of TMP The cost of monitoring should be included in the Contractor's budget Engineer The environmental specialist reviews and manages the TMP The cost of the control work will be included in the Engineer's budget RD Supervise the Engineer	monitoring schedule The Plan must be developed and validated prior the commencement of construction activities
10. Handling hazardous substances	Accidental or chronic leakage or spillage of diesel fuel, oil or other toxic substances	All Construction sites, Designated hazardous material storage areas	Documentation review Sites' visits	The Emergency Response Plan is available for review Accident report forms are completed whenever an accident happened All accidents are treated in compliance with the Plan	Contractor Development and monitoring of Emergency Response Plan	According to regular formal monitoring schedule The Plan must be developed and validated prior the



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
	Diesel, asphalt, mixed bitumen, used oil and grease			<p>The Emergency Response Team members have received their training</p> <p>Appropriately stored in designated areas, the saved record is updated, and the materials are labelled</p>	<p>The cost of monitoring should be included in the Contractor's budget</p> <p>Engineer</p> <p>The environmental specialist reviews and manages the Emergency Response Plan</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p> <p>Supervise the Engineer</p>	commencement of construction activities
11. Waste and other materials management	Management of waste and construction materials during construction activities	<p>All Construction sites</p> <p>Designated waste disposal sites</p>	<p>Documentation review</p> <p>Sites' visits</p>	<p>The Waste Management Plan is available</p> <p>The "Waste Research Center" SNCO under the Ministry of Environment provided the classification of construction waste</p>	<p>Contractor</p> <p>Development and monitoring of Waste Management Plan</p> <p>The cost of monitoring should be included in the Contractor's budget</p>	<p>According to regular formal monitoring schedule</p> <p>The Plan must be developed and validated prior the</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
				<p>Engineer has approved waste disposal sites and all permits for waste disposal are obtained</p> <p>Garbage, rubbish and improper construction materials are managed in compliance with Plan’s instructions.</p> <p>A waste register has been developed and is correctly completed</p> <p>No waste outside designated areas</p>	<p>Engineer</p> <p>The environmental specialist reviews and manages the Waste Management Plan</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p> <p>Supervise the Engineer</p>	<p>commencement of construction activities</p> <p>Monthly reporting on waste management</p>
12. Site Reinstatement, Landscaping, and Re-vegetation	<p>Construction site is cleaned, no material and waste are on-site</p> <p>Restoration of all surfaces in quarries, borrow pits, concrete and asphalt batching</p>	<p>All Construction sites</p> <p>Identifying of areas for landscaping</p>	<p>Sites’ inspections</p> <p>Counting of number of planted and dead trees</p>	<p>The Site Reinstatement, Landscaping and Re-vegetation Plan is available</p> <p>All surfaces in quarries, borrow pits, concrete and asphalt batching plants that were used temporarily during construction are restored to their original state</p> <p>The site restoration checklist has been approved by the RD</p> <p>Location and number of trees and bushes planted is complies with the landscape design documents</p>	<p>Contractor</p> <p>Development and monitoring of Site Reinstatement, Landscaping and Re-vegetation Plan</p> <p>Restoration of all surfaces</p> <p>Vegetation restoration works</p> <p>Maintain landscape areas over the period</p>	<p>According to regular formal monitoring schedule</p> <p>The Plan must be developed and validated prior the commencement of construction activities</p> <p>Restoration of all surfaces must be</p>



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
	<p>plants that were used temporarily during construction</p> <p>Site is re-vegetated</p>			<p>Trees and bushes seedlings have survived the liability period.</p> <p>Maintenance and monitoring the health of trees until viable within 3 years</p>	<p>specified in the contract</p> <p>The cost of monitoring should be included in the Contractor's budget</p> <p>Engineer</p> <p>The environmental specialist reviews and manages the Site Reinstatement, Landscaping and Re-vegetation Plan</p> <p>The cost of the control work will be included in the Engineer's budget</p> <p>RD</p> <p>Supervise the Engineer</p>	<p>finished before the project is handover to MTAI.</p> <p>Health state and growth of bushes and trees is checked twice every year, in late spring and early fall during the liability period</p>
13. Records and reporting	Site inspection checklists,	Recorded information	Review	All available, recorded correctly, any follow-up has been carried out as required	Contractor Completes and monitors checklists, logs, consultation	The Contractor submits a weekly monitoring report, monthly progress reports and completion



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
	Site inspection minutes, Register books Consultation records, Training records, Licenses, and permits				records, training records Obtains Licenses, and Permits <u>Engineer</u> Ensure compliance, Report to RD <u>RD</u> Review the Engineer reports Report to the ADB	report to the Engineer The engineer submits a monthly progress report The final report of the stage must be submitted An audit report must be submitted RD submits bi-annual reports to the ADB



Location / Activity phase (as relevant)	Parameters to be Monitored	Monitoring Location/s	Instruments & Method	Environmental Performance Indicator	Responsible Entities	Frequency
OPERATION PHASE						
(If necessary, it should be updated by the RD environmental specialist before the start of the operation phase.)						
14. Landscaping	Normal growth of trees and shrubs	All areas where landscaping works have been carried out	Site visits construction work areas	Growth of trees, shrubs, sanitary condition	<u>Contractor</u> <u>MTAI /RD</u> Landscaping works, sanitary condition of trees and bushes and growth control during operation before handing over to "Hayantar" SNCO	At the end of the work, at the stage of elimination of defects, if necessary, before the signing of the handover act
15. Safety		Project alienation zone			<u>Security is monitored by the police</u>	



ANNEX 3: DETAILED MAPS OF KAGHARAN-AGARAK ROAD SECTION

Below are presented the detailed maps of Lot 1 and Lot 2 sections with all the planned infrastructure:



Figure 32: Lot 2, part 1

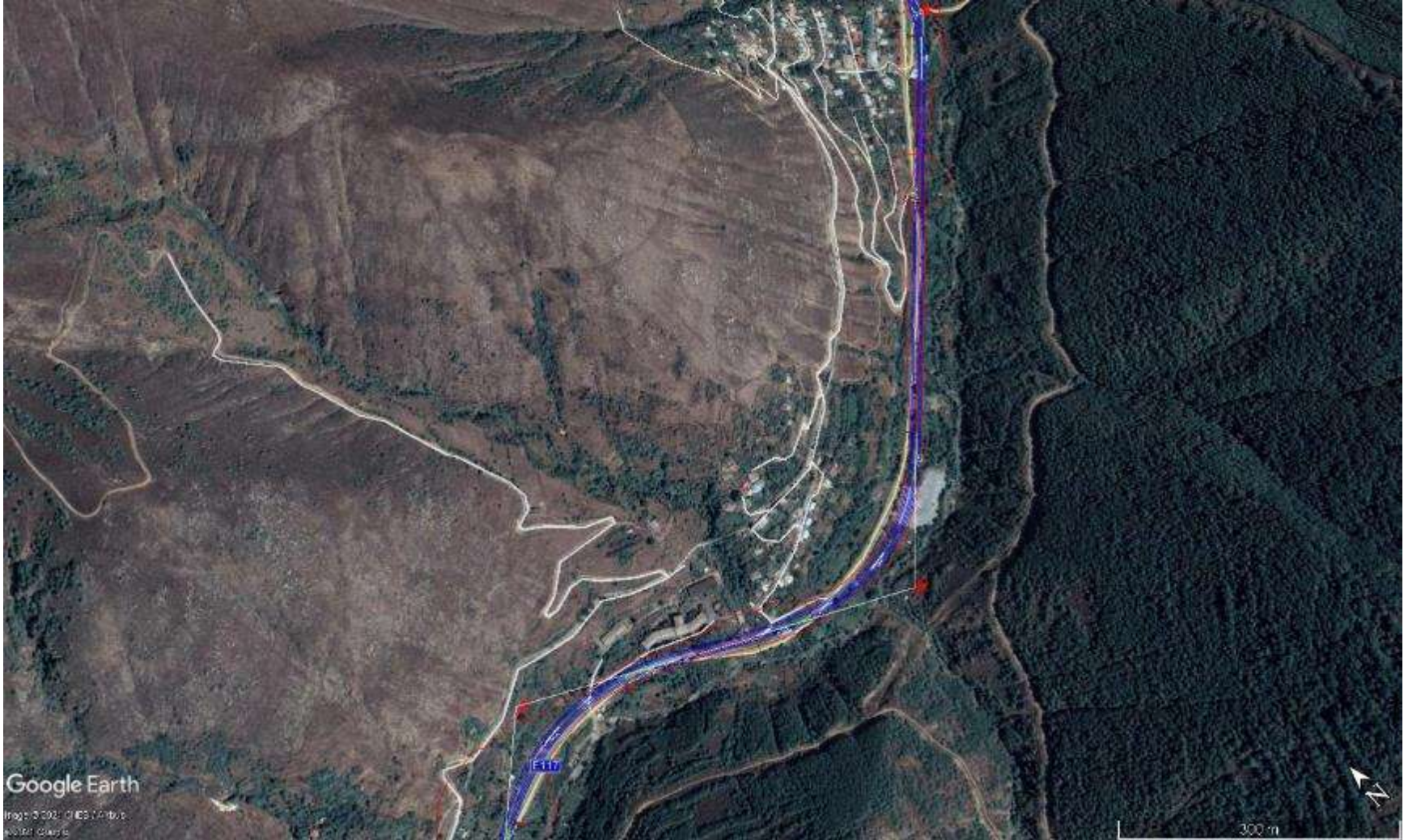


Figure 33: Lot 2, part 2



Figure 34: Lot 2, part 3

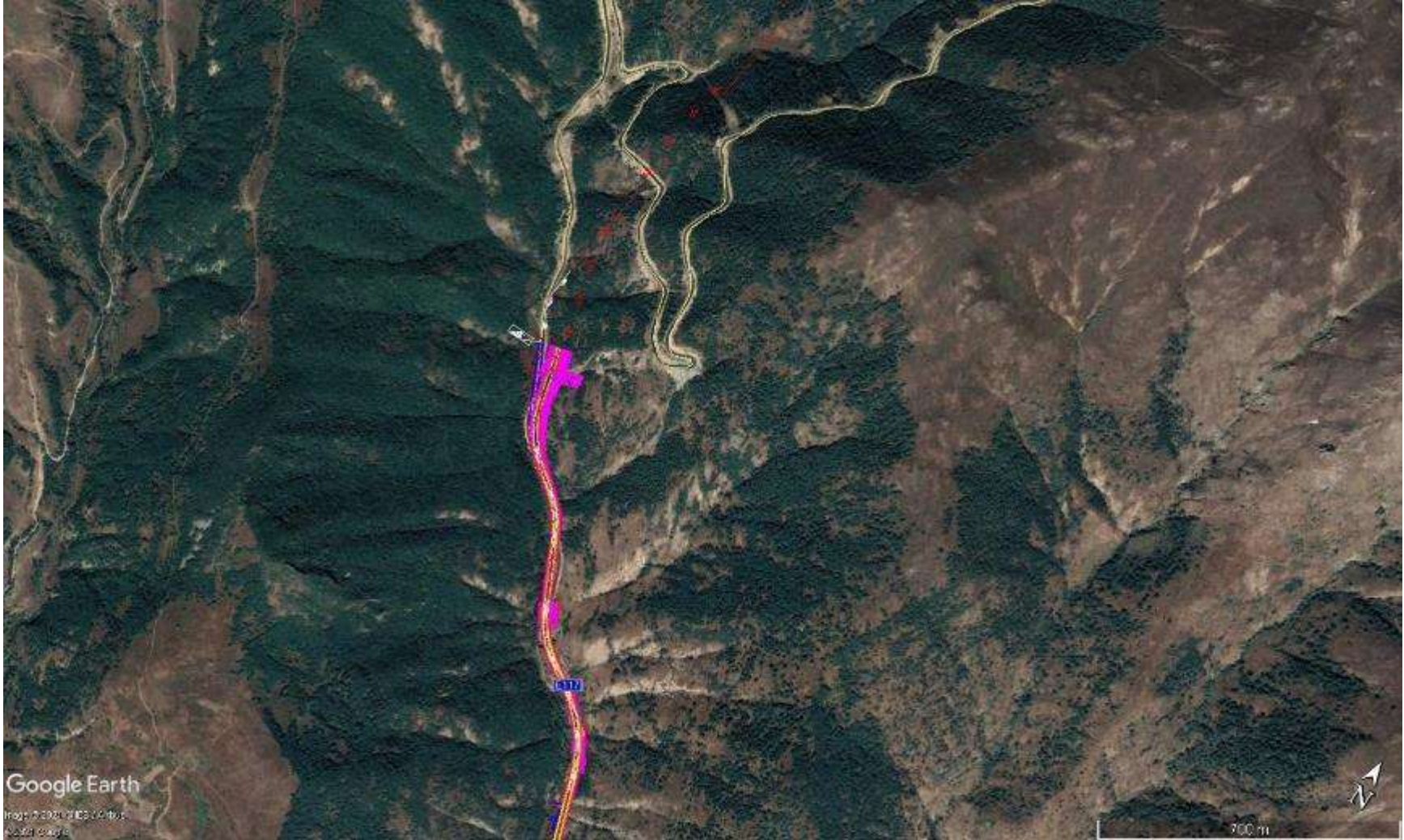


Figure 35: Lot 1, part 1

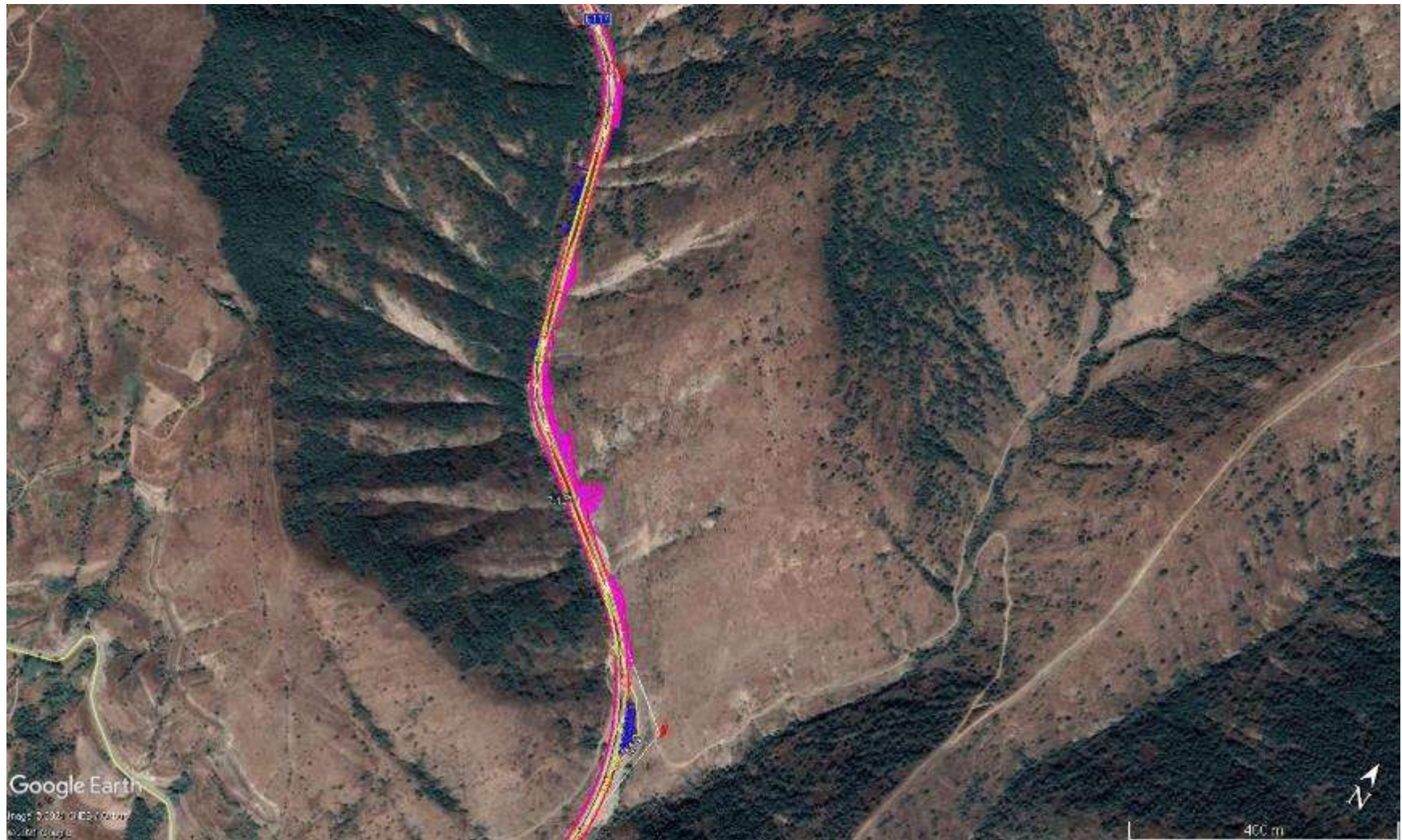


Figure 36: Lot 1, part 2



Figure 37: Lot 1, part 3



Figure 38: Lot 1, part 4

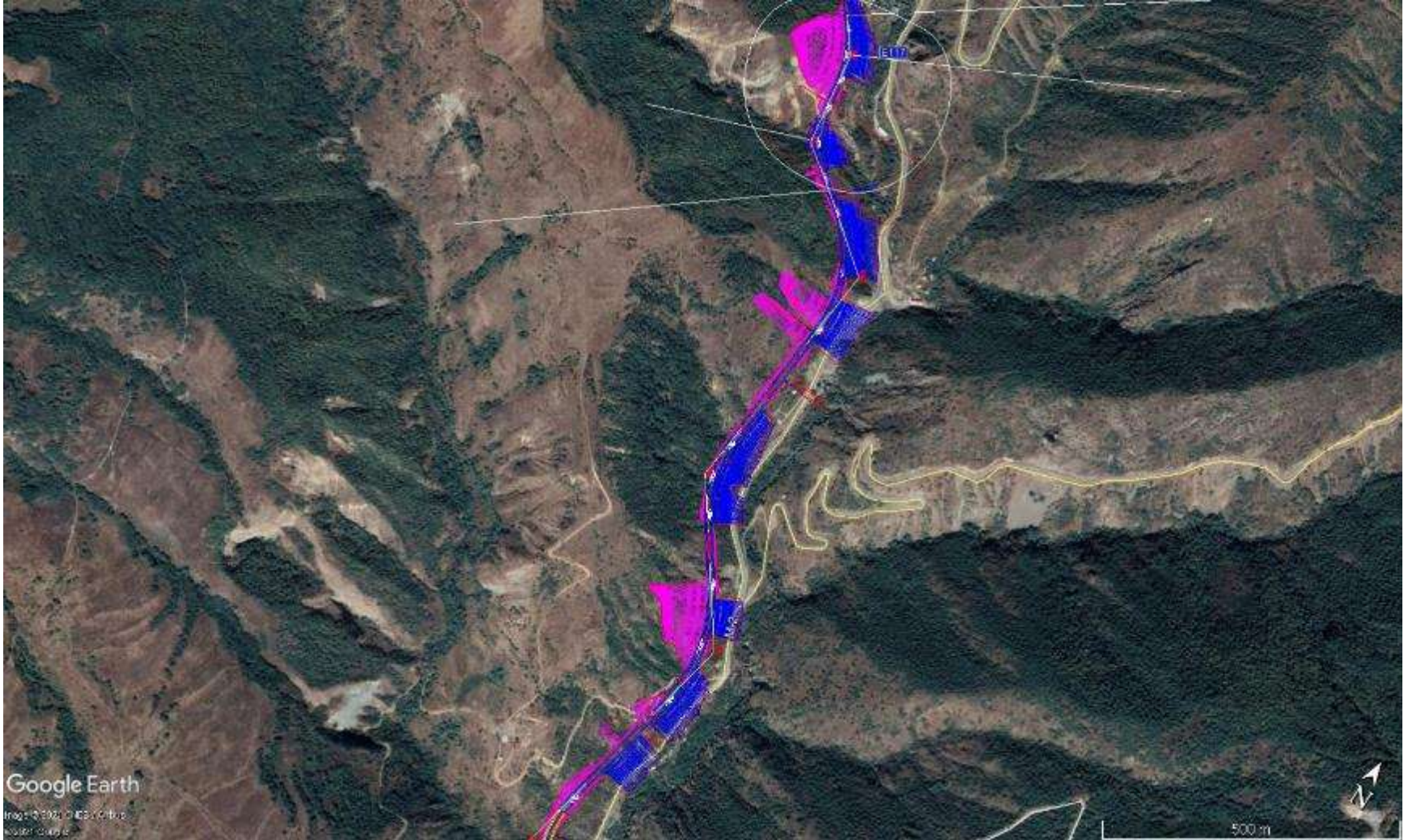


Figure 39: Lot 1, part 5



Figure 40: Lot 1, part 6

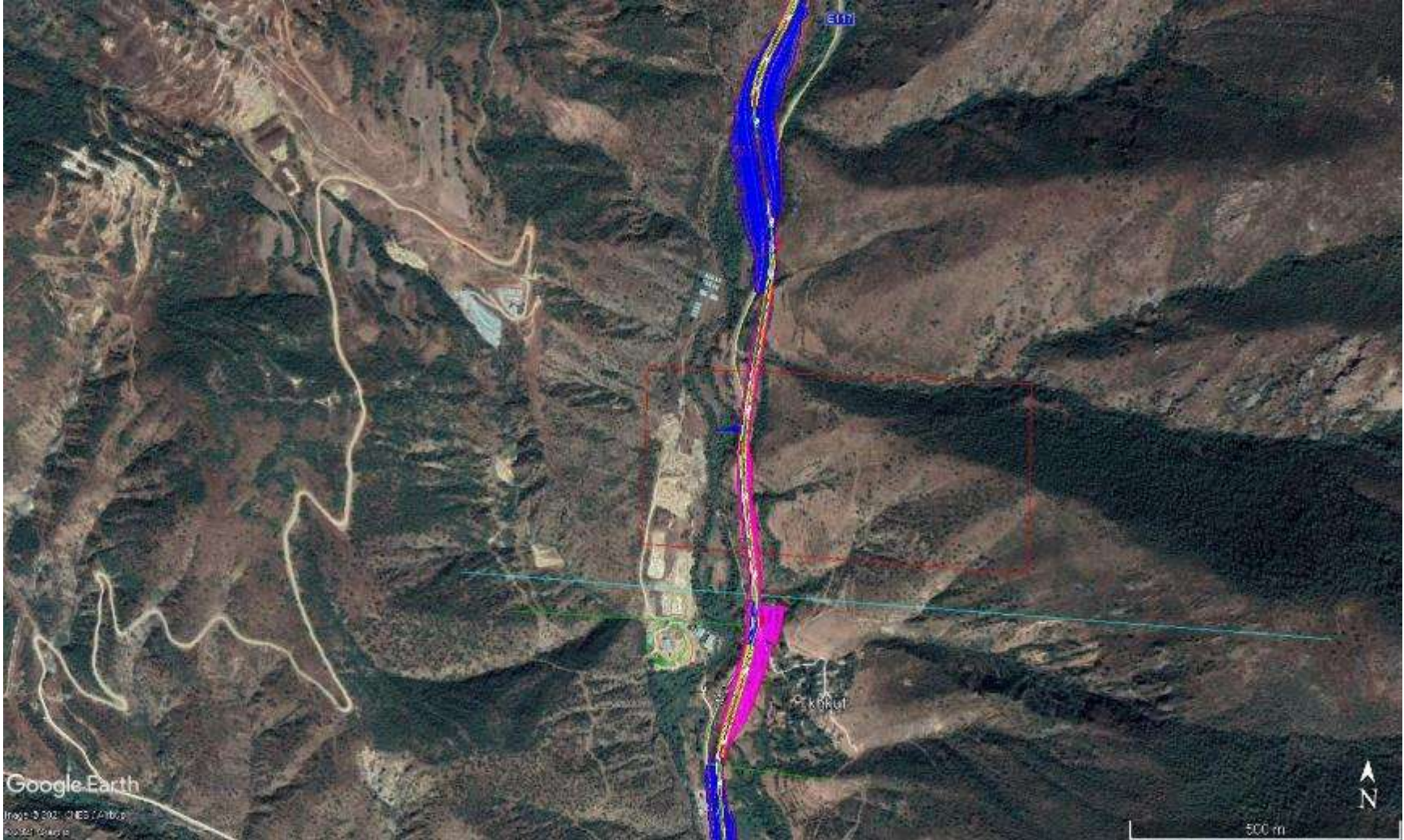


Figure 41: Lot 1, part 7



Figure 42: Lot 1, part 8

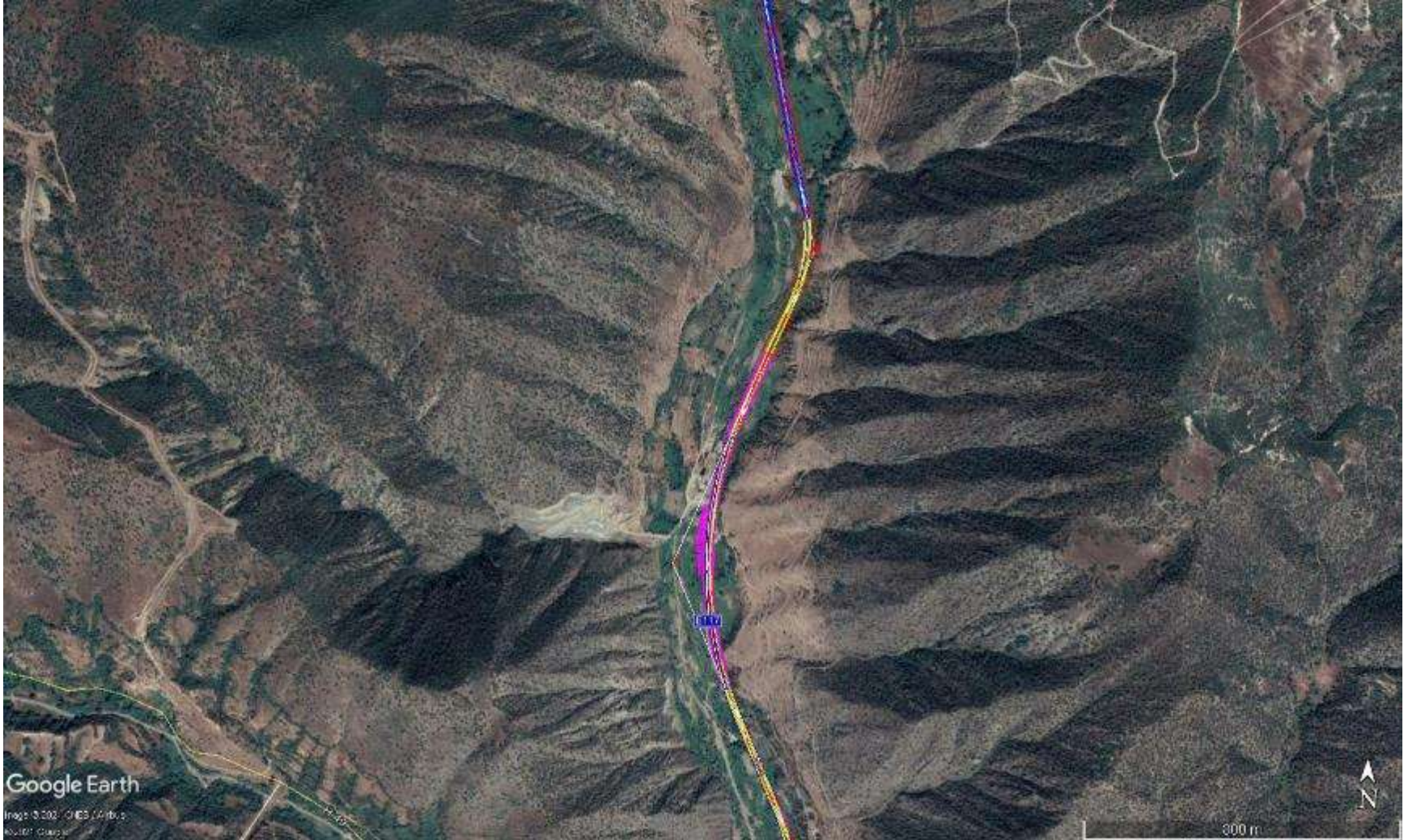


Figure 43: Lot 1, part 9



Figure 44: Lot 1, part 10



Figure 45: Lot 1, part 11



Figure 46: Lot 1, part 12



Figure 47: Lot 1, part 13



Figure 48: Lot 1, part 14



Figure 49: Lot 1, part 15



ANNEX 4: CLIMATE DATA

Table 24: Climate data

Description	Data	
	Kajaran	Kapan
Climatic zone	1980-III	I - 705
Altitude marks	2200-2490 m	800-1150
Weather in summer	cool	hot and dry
Weather in winter	severely cold	cold windless
Annual average air temperature	6.9 ⁰ C	11.9 ⁰ C
Average temperature in the coldest month	- 2.7 ⁰ C	0.8 ⁰ C
Average temperature in the warmest month	16.6 ⁰ C	23.3 ⁰ C
Passage of temperature through 0 ⁰ C	March - December	February - December



Absolute maximum temperature in summer	34 ^o C	42 ^o C
Minimum temperature in winter	- 22 ^o C	- 22 ^o C

Annual dominating wind directions in summer	western	west and south - west
Annual dominating wind directions in winter	western	west and south - west
Annual average wind speed	1.6 m/sec.	1.1 m/sec.
Annual precipitation	686 mm	585 mm
Maximum water content in snow	242 mm	70 mm
Formation of snow blanket	December	December
Melting of snow blanket	March	February




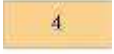



Number of days with snow blanket	150	30
Rated height of snow blanket with 5% provision	90 cm /Lichk/	29 cm
Number of snow-stormy days	5-10	-
Glaze	2-3 days	-
Maximum depth of soil freezing	92 cm /Sisian/	14 cm









ANNEX 5: LEGENDS OF MAPS

Geomorphology map legend

TYPES OF RELIEF		
STRUCTURAL EROSIVE RELIEF		
High mountains (over 2800 m)		
	With snow-glacial relief forms, severely splitted, sharp and rocky crests, sloping sides up to 35°/	With intensive folded base of massive clastic and volcanogenic-sedimentary rocks of intrusive rocks
	With steep slopes (up to 25° - 35°), slightly wavy watershed	
Medium-height mountains (1500-2800 m)		
	With steep slopes (up to 25° - 35°), slightly wavy watershed	With intensive, partially moderate folded base of volcanogenic-clastic and continental carbonate rocks complicated with intrusive
	With moderately steep slopes (up to 25° - 35°), slightly wavy watershed	With folded clastic structures of intrusive and volcanogenic-sedimentary rocks
II. TECTONIC-VOLCANIC AND VOLCANO-EROSIVE LANDFORM		
	Shield-shaped elevated (over 2800 m), mountain massifs covered with lava and folded clastic	



	structures heterogeneous in the base, levelled, complicated by tectonic disturbances	
	Slopes and plateaus (1500-2800 m) "armoured" with lava sheets, slightly splitted in the base, folded structures complicated with disturbances	
	Marginal plateaus (1100-2200 m) covered with lava, on slightly sloped folded structures	
	Lithosculpture plateaus and slopes composed of pyroclastic (volcanoclastic, loose) molasses	
	Tuff covers with slightly folded base	
III. EROSIVE (DEVELOPED) LANDFORM		
Medium-height mountains (1500-2800 m)		
	Inverted	a) intensive folded base of volcanogenic-carbonate suites
		b) volcanoclastic-proluvial strata with slightly folded base
	Transverse and oblique mountain ranges and plateaus	a) sedimentary-volcanogenic, with carbonate intensive folded base
		b) slightly sloped or monoclinial folded base of volcanogenic, carbonate rocks













Low mountains, plateaus and foothills (up to 1500 m)		
	a) Erosive, splitted	With folded, partially slightly folded base of carbonate, sedimentary-volcanogenic rocks
	b) Arid erosive, severely splitted	With folded base of heterogeneous rocks
	Monoclinial piedmont plateaus with accumulative (boulder - sand - crushed stone) cover	With slightly folded base
IV. ACCUMULATIVE (SEDIMENTARY, ALLUVIAL) LANDFORM		
Plains		
	Alluvial-deluvial, tableland	
	Alluvial-deluvial, tableland	
	Alluvial	
	Alluvial-proluvial foothills, slightly oblique	
	Lacustrine	












18	Lacustrine-fluvial-glacial	
N ₂ -Q ₂	Age of morphostructures	

LANDFORMS		
1. SNOW-GLACIAL		
	Cirques (kars)	
	Troughs (trough valleys)	
	Moraines	
	Exaration forms	
2. HYDROEROSIVE AND HYDROACCUMULATIVE		
	Hollows	



	V-shaped narrow valleys	
	Wide valleys with gully and terraces	
	Canyons	
	Deep gorges	
	Alluvial cones	
3. EROSIVE		
	Archaic peneplain surfaces	
	Cuestas	
	Relicts	
	“Soil pyramids”	
	Denudation (bad lands)	



	Karst caves	
	Suffosion forms	
4. BENT UNDER LOAD		
	Collapses	
	Landslides	
5. VOLCANIC		
	Stratovolcanoes	
	Extrusive mountain massifs	
	Slag cones	
	a) wavy	Lava flows
	b) clastic	



	Placers	
	Axes of anticlinal structures	
	Disjunctive disturbance lines	
	Axes of synclinal structures	

Geology Map Legend

(the absolute age in million years is presented in parentheses)

	Holocene basalts, andesites (0.01)
	Neo-Pleistocene - Holocene basalts, andesites (0.85-0.01)
	Upper pliocene - pleistocene lacustrine, fluvial, proluvial, slope deposits (3.3-0.01)
	Neo-Pleistocene basalts, andesites, trachyandesites, dacites (0.85-0.01)



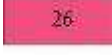








5	Upper Eo-pleistocene basalts, andesites, trachyandesites, dacites (1.2-0.85)
6	Yerevan, Ani, Artik, Byurakan and other various types of ignimbrite tuffs of Eo-pleistocene age, tuff lava (1.78-0.85)
7	Upper pliocene - Eo-pleistocene basalts, andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias, travertines (3.3-0.85)
8	Upper pliocene dolerite basalts (3.6-1.7)
9	Upper Miocene - Lower pliocene andesite basalts, andesites, dacites, rhyolites, obsidians, perlites, tuff-breccias, tuff-sandstones, pumice basins (7.1-3.6)
10	Middle - Upper Miocene sandstones, clays, gypsum, rock - salt, petroliferous shales (14.4-5.3)
11	Upper oligocene - Lower Miocene clays, sandstones, conglomerates, petroliferous shales, brown coals, andesites, sanidine trachytes, tuff-breccias, ignimbrite tuffs (24-14)
12	Lower Oligocene clays, sandstones, marl stones, conglomerates, reef limestones (38-33)
13	Upper Eocene basalts, andesites, tuff-breccias, tuff-sandstones, clays, aleurolites, marl stones, limestones (42-38)
14	Middle Eocene andesites, tuff-breccias, tuff-sandstones, tuff-aleurolites, volcanogenic-sedimentary flysch, marl stones, limestones (50-42)






15	Paleocene - Lower Eocene clays, argillaceous sandstones, aleurolites, marl stones, laminated limestones, lava flows of olivine basalts (65-53)
16	Upper Cretaceous conglomerates, sandstones, marl stones, limestones, radiolarite, tuff-breccias, basalts, spilites, diabases (96-65)
17	Lower Cretaceous limestones, aleurolites, metamorphic laminated limestones, aleurolites, tuff-sandstones, basalts, andesite basalts (135-96)
18	Upper Jurassic - Lower Cretaceous basalts, andesites, tuff-sandstones, tuff-aleurolites, limestones (154-135)
19	Upper Jurassic basalts, andesites, tuff-breccias, tuff-sandstones, limestones, dolomites, sandstones, clay shales (175-135)
20	Lower - Middle Jurassic aleurolites, sandstones, hard coal strata, basalts, andesites, rhyolites, tuff-breccias, tuff-sandstones (203-135)
21	Upper Permian - Triassic dolomites, clay shales, sandstones, hard coal and petroliferous shales strata (258-203)
22	Devonian - lower carboniferous limestones, sandstones, quartzly sandstones, clay shales (385-315)
23	Carboniferous metamorphic rocks, various shales (~315)
23 ^{uu}	Upper Proterozoic metamorphic rocks, various shales, phyllites, amphibolites, marbles, dolomites, metamorphic volcanogenic formations (600-800)



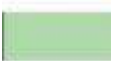


INTRUSIVE FORMATIONS	
	Upper oligocene - Lower Miocene porphyraceous granites, granodiorites (24-14)
	Upper Eocene - Lower Oligocene granodiorites, granites, granosyenites, nephelinic and alkaline syenites, monzonites, gabbroes (38-33)
	Upper Eocene gabbroes, granodiorites, quartz diorites, monzonites, nephelinic syenites, leucogranites (42-38)
	Middle Eocene granodiorites, quartz diorites, gabbroes (50-42)
	Mesozoic (pre - Upper Cognac) ophiolite complex: gabbroes, troctolites, plagiogranites, quartz diorites (28), peridotites, harzburgites, lherzolites, pyroxenites, dunites, serpentinites (29) (96-65)
	Upper Jurassic - Lower Cretaceous tonalites, quartz diorites, leucogranites (154-135)
	Middle Jurassic plagiogranites, leucogranites (203-175)
	Upper Proterozoic trondhjemites, gneissose granites, albitites, serpentinites, gabbroes
	Quaternary volcanic centers



	Central crater of the Aragats multigenic volcano
FRACTURES	
	1-Primary a) actual b) presumptive
	2-Secondary a) actual b) presumptive

Landslide map legend

	Landslides
	Large landslide areas
Zones of weathering	
	Thermochemical










	Thermobiochemical
	Thermofrost
	Isolines of neotectonic upheavals (km)
	Tectonic disturbances
	Borders of basins
	Lake Sevan
	Fluvial, second category
	Fluvial, third category
	Fluvial, fourth category

Mudflows Map Legend



The maximum volume of solid phase from 1 km³ of active area of mudflow formation in case of one mudflow (thous. m³/km³/)

	Strong (15-35)
	Medium (5-15)







	Weak (up to 5)
SITES	
	Accumulation of the solid phase of mudflow
	Potential in the past, mudflow-bearing currently
	Potential mudflow-bearing
	Not mudflow-bearing
TYPE OF MUDFLOW AND DENSITY OF THE MASS, (γ_d - kg/m ³)	
Mud-stone	
	$\gamma_d=1700$
Sedimental	
	$\gamma_d=1500-1700$



	$\gamma_d=1300-1500$
	$\gamma_d=1100-1200$

Legend of Seismic zoning map

Possible intensity of earthquake (j) and maximum horizontal accelerations of rivers (g) (probability of no exceedance in 500 years - 90%)

	Possible intensity of earthquake (j)	Maximum horizontal accelerations of rivers (g)
	10 and more	0.4-0.5
	9	0.3-0.4
	8-9	0.2-0.3
	8	0.1-0.2
g - m/sec. ² in the international system of units		



J - point (MSK - 64)

Legend of Seismotectonics map

	Lateral shifts
	Faults
	Uplift faults
	Intense seismic focuses
M=7.3 Magnitude of earthquake	
1988 Date of earthquake	



ANNEX 6: FLORA AND FAUNA

Biodiversity

The geographical location and the relief of Armenia have contributed to the formation of rich biodiversity and endemic. Around 3800 high class flowering plants and more than 17500 animal species were identified in the area of Armenia, from which 500 are vertebrates. The number of lower-class plants and microorganisms exceeds a few tens of thousands.

Methodology of biodiversity investigation

Investigation of the environment is conducted in two phases: office and field works.

Office works

During the office works phase, available published material regarding the biodiversity of the investigated area and its legislative framework is studied, lists of *fauna* and *flora* representatives are prepared, the peculiarities of their habitats and lifestyle, as well as external descriptions of fauna and flora species are clarified. Special attention should be paid to *the flora and fauna* representatives registered in the *Red Book of the RA Plants and Animals*, and their endemic. Cartography materials and ecumenic photos can serve as a good source for the investigation.

Biodiversity field research phase

Field investigations will be conducted in a classic geological investigation method. The investigated area is distinguished by the main biotopes, taking into consideration the local relief and the landscape which include all the diversity of micro-relief. During the research, all seen species of plants and animals are recorded, photographed. If it is not possible to define the flora species during field investigations, samples from the species or its separate organs will be taken for further investigation in labs. Definition of plant species and their names in labs shall be conducted with the use of the 11-volume book of the “Armenian Flora” (1954-2010) and other professional literature.

The investigation of the fauna will be conducted in parallel with the investigation of the flora, in accordance with the biotopes. Birds are normally observed with binoculars and are compared with the data of the field guide (Martin S. Adamyan, Daniel Klem Junior, “Birds of Armenia” field guide, ISBN: 0-9657429-5-4) on the spot. In rare cases traps can be installed or ambushes and night watches arranged. During field works information shall also be collected from the local population.

The status of rare and endangered species shall be clarified according to the Red Books of Plants and Animals of Armenia, as well as the criteria developed by the commission of the International Union for Conservation of Nature and its Resources.

Ecosystems of the Kajaran-Agarak Section of the North-South Highway



The project of the highway envisaged almost completely (except for the tunnel section) passes first through Voghji, then through Meghri river gorges and river valleys, making numerous river crossings.

Based on the specifics of the ecosystems, the highway route is divided into sections for the purpose of a systematized study of the biodiversity of the project area. It is clear that those divisions are artificial to some extent, since no clearcut boundaries of ecosystems can be defined and often the ecosystems penetrate into each other because of the above-mentioned reasons.

The specifics of the highway ecosystems are presented in a table. The approximate volume of the direct impact of the highway on the natural environment is presented by photos taken with Google Earth.

Table 25: Specifics of the ecosystems of the highway route*

N	Name, length of the highway (linear construction), and the total area of its direct impact on the natural environment	Highway (linear construction) starting and ending point elevation m.a.s.l. and the magnitude of elevation decrease	Specifics and description of the ecosystem of a particular section of the highway
1	Section from Lernadzor to Kajaran	1540 m-1530 m =10 m	Reconstruction of an existing road
2	Section bypassing the village of Lernadzor 1,8 km, 12,6 ha	1610 m-1540 m = 70 m	A- Mixed sparse forest with prevalence of Quercus and Carpinus, two fords are envisaged
3	Entrance of the Lernadzor tunnel – Kajaran intersection 1,52 km 10,6 ha	1640 m-1610 m = 30 m	B- Highland river vally ecosystem, a ford is present
4	Lernadzor tunnel- Meghri river valley	1920 m-1640 m= 280 m	Underground structure
5	The roadblock of the Meghri river valley tunnel exit 0,6 km, 5,0 ha	1920 m-1970 m =-50 m	C- Lush forest with prevalence of Quercus, V-type river valley
6	Tashtun section 2,62 km	1770 m-1920 m = -150 m	Reconstruction of an existing road
7	Lichk village section 2,77 km, 22,1 ha	1610 m -1770 m = -160 m	D- Deciduous dry sparse forest with prevalence of Quercus
8	Lichk – Vardanidzor section	1090 m- 1540 m = -450 m	E- Quercus and Juniperus dry sparse forest, shrubs and scrubs



	8,2 km, 65,6 ha		
9	Vardanidzor intersection 5,7 ha, 0,67 km	1050 m- 1090 m = -40 m	F- Low river-bed ecosystem, one ford
10	Vardanidzor-Meghri section 6,1 km	760 m-1050 m =-290 m	Reconstruction of an existing road
11	Northern intersection of Meghri and the fords 3,5 ha 0,6 km	740 m-760 m = -20 m	G- Gardens, low river-bed ecosystem, two fords
12	Bypassing of the town of Meghri from the west 28,8 ha, 3,6 km	600 m-740 m =-60 m	H- Dry, rocky semi-desert slopes, sparse shrub ecosystem
13	Bypassing of the town of Meghri from the east 4,3 ha, 1,35 km	540 m- 600 m= -60 m	I- Dry, rocky semi-desert slopes with the presence of shrubs, a river-bed, two fords
14	Meghri – Agarak-Nrnadzor intersection 2,7 ha, 0,6 km	530 m-540 m=-10 m	J- Ecosystem of gardens and sparse shrubs

*The numbers presented in the table were obtained during the development of the highway route by Google Earth. Those numbers give a general idea on the subject matter, however, the approximity is quite sufficient for the subject in consideration.

Thus, the route of the observed highway section crosses ten ecological systems (A-J), with elevations of 1920 to 540 m.a.s.l. The purpose of this analysis was to conduct the planning of the field investigation.



Figure 50: The North-South highway route at the section of Lernadzor village until the tunnel entrance, on a photo taken with Google Earth. The section of the reconstructed road until the village of Lernadzor is indicated in yellow, the section bypassing the village of Lernadzor is indicated in light blue-A (deciduous forest with prevalence of *Quercus* and *Carpinus* –A), the highway’s Lernadzor – tunnel entrance – Kajaran intersection (highland river valley ecosystem –B) is indicated in dark blue.



Figure 51: The North-South highway route, the tunnel exit, on a photo taken with Google Earth. The boundaries of the direct impact of the highway tunnel exit's block on the natural environment (dry Quercus forest and river valley –C) are indicated in blue.



Figure 52: The North-South highway route section of Lichk village, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (dry deciduous sparse forest with prevalence of *Quercus* –D) are indicated in purple.



Figure 53: The North-South highway route section of Lichk – Vardanidzor, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (dry sparse forest of *Quercus – Juniperus*, shrubs and scrubs- E) are indicated in light mustard yellow.



Figure 54: The North-South highway route intersection of Vardanidzor, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment are indicated in blue (F).



Figure 55: North-South highway route of the Meghri northern intersection and fords, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (gardens, low river-bed ecosystem –G) are indicated in blue.



Figure 56: The North-South highway route, bypassing the town of Meghri from the west, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (ecosystem of dry, rocky, semi-desert slopes and sparse shrubs –H) are indicated in light purple.



Figure 57: The North-South highway route, bypassing the town of Meghri from the east, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (ecosystem of dry, rocky, semi-desert slopes, sparse shrubs, and a river-bed -I) are indicated in blue.



Figure 58: The North-South highway route intersection of Meghri – Agarak – Nrnadzor, on a photo taken with Google Earth. The boundaries of the direct impact of the highway on the natural environment (ecosystem of gardens and sparse shrubs -J) are indicated in white.



The results of the conducted field research are presented below.

The studied area starts from the town of Kapan to Lernadzor at point 39°09'53,2" N, 46°12'42,1 "E, 1534 m.a.s.l. The right side of the road includes rocks with phryganoid vegetation, and with petrophile vegetation on rock fractions. In some parts, the rocky slopes are cut by small landforms, where dry sparse forests can be encountered. Sections of sparse forests can be encountered in higher locations of the right hillside, there are open areas with white crop-weed plant coexistences. An artificial planter of *Pinus sylvestris* var. *hamata* can be found at the beginning of the road. Emergent layers of temperate deciduous forest can be identified in higher locations.

The Voghji river gorge is situated on the left side of the road. The riverbed forest layer will not be impacted. There are some private lands on the road going up from the left side of the river, where cultivated plants and fruit trees can be found.

In the section of the community of Lernadzor, the road passes from the left side of the existing road – through the riverbed forest layer of the Voghji river gorge, where *Quercus* prevails, as well as through the neighboring planter area. In the area outside the village, the roads nearly coincide all the way to the entrance of the tunnel.

The entrance of the first tunnel will be inclined, at the foot of the forested mountain slope - 39°08'55,00" N, 46°10'52,21 "E, 1650 n.a.s.l. A temperate deciduous forest with its specific plants can be seen in the area.

The tunnel exits to the area of Arevik National Park - 39°05'21,81" N, 46°10'14,45 "E, 1975 m.a.s.l. On the right side of the road, the V-shaped gorge of the river of Meghri can be found. The right-side mountain slopes of the river are represented with temperate deciduous forests with the prevalence of *Quercus*.

The riverbed forest layer of the river gets sparse gradually as it goes towards the road, separate representatives of dendroflora can be found. An artificial small planter of *Pinus sylvestris* var. *hamata* is present.

There is a *Quercus-Carpinus* deciduous forest on the left side of the road, immediately next to the tunnel. In some parts, the forest is replaced by a sparse forest down the riverside, and then mountainous xerophytic shrubs can be found, as well as scrubs with the prevalence of *Spirea* and sections of *tragacanth*s.

The mountain slopes are represented with high mountainous zone xerophyte shrubs towards Meghri where *tragacanth*s follow with the presence of *Astragalus aureus*.

The left side of the park area ends at point 39°04'38,25" N, 46°10'48,60"E, 1865 m.a.s.l. A dry forest starts which are followed by mountainous xerophyte vegetation.

The national park is still situated on the right side of the road. In that area, the road passes along the lower border area of Arevik national park. Here a temperate deciduous forest can be seen which is followed by a sparse forest. In this section, the border of the National Park ends at the point of 39°04'66,65" N, 46°11'16,59"E, 1787 m.a.s.l.



Following that, before entering the Gozgoz river gorge, the road crosses the territory of the national park again, passing through the territory of the national park starting from 39°03'55,12" N, 46°11'16,05"E, 1761 m.a.s.l. section and exiting the territory of the national park at point 39°03' 47, 44" N, 46°11'15,24 "E, 1745 m.a.s.l. There is a dry sparse forest situated in that area of the national park.

At point 39°03'44,13" N, 46°11'16,35 "E, 1735 m.a.s.l. the road enters the gorge of the left-side tributary of Meghri, the Gozgoz river gorge.

In the canyon, the road passes through the right-side slopes of the V-shaped gorge of the river Gozgoz. Before entering the tunnel, the road passes through a temperate deciduous forest, with the prevalence of *Carpinus*, at parts separated by rock fractures with typical petrophile vegetation. In some sections, the road also passes through glades and sparse forests. Xerophyte shrubs are situated on the left-side slopes of the canyon, there are also deciduous sparse forest sections there. The area also includes rocks with petrophile vegetation. Before the entrance of the second tunnel, sections of temperate deciduous forests can also be found in the left-side mountain slopes with the prevalence of *Quercus*. The left-side slopes of the canyon are not going to be impacted by the program.

There is a semilunar medieval stone bridge in the canyon (39°03'30,1" N, 46°11'43,5 "E, 1667 m.a.s.l.).

The entrance of the second tunnel is going to be in the area of the temperate deciduous forest - 39°02'41,68" N, 46°12'11,49 "E, 1605 m.a.s.l. There is a sparse forest situated above the tunnel on the right slope. The second tunnel enters in the area of 39°02'34,53" N, 46°11'59,69 "E, 1555 m.a.s.l. A dry sparse forest is situated on the sloping hillside of the tunnel exit, at parts with rock fractures.

Undercutting the river of Meghri, it passes through the dry sparse forest, above the summer houses, and then through the slope with xerophile vegetation.

At point 39°02'03,79" N, 46°12'16,50"E, 1489 m.a.s.l., the road enters the territory of Arevik National Park, where the temperate deciduous forest is followed by a sparse forest, at parts with rock fractures.

At point 39°01'54,58" N, 46°12'18,07"E, 1484 m.a.s.l., the road starts from the territory of Arevik National Park. Xerophytic shrub scrubs start here.

At point 39°01'48,16" N, 46°12'17,39 "E, 1463 m.a.s.l., the road enters the territory of the National Park again. It crosses a temperate deciduous forest, glades, it then enters into a section with rocks, and on point 39°01'35,57" N, 46°12'23,58 "E 1444 m.a.s.l., it exits the territory of the National Park.

Prior to crossing the old road, the road passes through the right side of the old road, in the sections of arid sparse forests. There are sparse forests with the prevalence of *Juniperus polycarpus* in that section. Xerophyte shrubs of the middle mountain zone follow the *Juniperus* forests, at parts scrubs and rocks can be seen.



At point 38°55',99" N, 46°12'25,70 "E, 1233 m.a.s.l., the road crosses the old road and passes through its left side. In that section, there is a ravine situated on the left side of the road, with a dry sparse forest. There is a shibliak on open slopes of the upper sections of the ravine. After that, the road continues through the dry sparse forest.

Passing through the sparse forest, the new road connects with the old one at point 38°59'35,56" N, 46°12'23,89"E, 1216 m.a.s.l., and within a certain distance the routes of the two roads coincide.

At point 38°59'18,16" N, 46°12'24,68 "E, 1182 m.a.s.l., the road turns left from the old road, passing across the xerophyte shrubs of lower mountains.

At point 38°59'05,12" N, 46°12'23,06 "E, 1146 m.a.s.l., the road turns right, crossing the old road and moving along the right side of the old road up until Vardanidzor – through the valley of the river of Meghri. Here the valley of the river of Meghri gets wider. The right-side hillsides are sloping, and these areas are abundant in Juniperus sparse forests. The sparse forest will not have any impact on it.

There are fords in this area. A river valley starts, typical of riverbed forest layers, at parts with some Rubus scrubs. There are planted old Quercus trees here, which are not going to carry the impact of the program. There are also three young Platanus Orientalis. The road passes through Vardanidzor, along the riverbed forest. There are Rubus orchards and private gardens there. The left slopes of the old road where certain plants are registered in the Red Book of the RA, are not going to be impacted.

Community of Vardanidzor - 38°58'15,7" N, 46°12'45,6 "E, 1067 m.a.s.l.

In the section from Vardanidzor to the community of Lehvaz, the new road will pass along the route of the old one. Both sides of the road are mostly occupied with orchards . At parts, in between the orchards, there are rocky hillsides or slopes covered with sparse forests. The new road will make a right turn in the section of Lehvaz to Meghri and then go through the foot of high rocks, where phryganoid vegetation can be seen. There are newly planted fruit trees with drip irrigation in this area. Bypassing Meghri's Pokr Tagh from the left, the road turns left and crossing the old road, it will be going through a few private orchards, entering towards the old road leading to Agarak and will coincide with the route of the old road all the way until Agarak.

Semi-desert vegetation types can be found in the section from the Meghri-Agarak crossroad until the community of Agarak with narrow layers at the foot of sloping hillsides of the rocks up the Araks river valley. On the right side, in the lowland hillside areas phryganoid vegetation can be found. There are concrete crossings built in the past for railway roads located on the left side of the road.

In this area, the valley of the river of Araks is wide, riverbed vegetation can be found here. The section of Agarak is the ending point of the highway currently under construction - 38°51'33,70" N, 46°12'49,73 "E, 538 m.a.s.l.

FLORA



The area requested for constructing the section of Kajaran-Agarak of the North-South highway route is located in the province of Syunik. The impact zone of the program encompasses section from the southern part of the floristic area of Zangezur and sections from the Meghri floristic area.

Since the impact zone of the requested area does not fully occupy the floristic areas, some vegetation types like steppes, mountains, and subalpine meadows, are not common here. The vegetation types that can be found in the area requested for the program include:

- Deciduous forests (deciduous sparse forests, sparse mixed forests, and sparse
- Conifer forests (Juniperus shrubs),
- Shibliak,
- Drought tolerant (mountain xerophile) vegetation (tragakanth shrubs, mountain xerophilte scrubs),
- Semi-deserts.

Besides the listed vegetation species interzonal vegetation species can also be found in the requested area, such as:

- Swamp vegetation (waterside vegetation, vegetation floating in water (water vegetation))
- Petrophile vegetation

FORESTS

Deciduous forests

The forests in the requested area are mainly distributed on highly sloping hillsides (30% and more). Forest coexistences with the prevalence of Juniperus and Carpinus are the most common in the area. A temperate deciduous forest with the prevalence of Juniperus can be found in the section bypassing the village of Lernadzor and on the Meghri river right-bank mountain slopes located at the exit of the first tunnel. A deciduous forest, with the prevalence of Carpinus, can be found on the right-side slopes of the Gozgoz river gorge, all the way to the second tunnel entrance.

Juniperus is one of the main elements contributing to forest formations. We do not have purely Juniperus forests in the requested area. Here Juniperus-Carpinus forests are common. Quercus Araxina is common on heights from 750 to 1200 m.a.s.l., it forms lighter forests and can be found in deciduous sparse forests. According to the m.a.s.l. height, Quercus iberica Stev. has participation in Quercus-Carpinus and other forest coexistences on heights from 1200 to 1500 m.a.s.l., and Quercus macranthera Fisch. et Mey can be found on heights of 1400-2500 m.

One of the main tree species contributing to the forest formation in the area is Carpinus betuleus L. from the Corylaceae. There is no ordinary purely Carpinus forests in the requested area; a Carpinus-Quercus Forest can be found, there are also Carpinus-Acer coexistences with the prevalence of Carpinus, often with the participation of representatives of Fraxinus and dendoflora. Here the following species can be found: Acer campestre L., Acer



hyrcanum Fisch. et Mey., *Acer ibericum* M. Bieb., from the Oleaceae, *Fraxinus excelsior* L., from the Rosaceae, *Pyrus caucasica*, *Pyrus georgica* Kuth., *Pyrus syriaca* Boiss., *Pyrus zangezura* Maleev., *Pyrus raddeana* Woronow, *Pyrus complexa* Rubtzov, *Sorbus aucuparia* L., *Sorbus torminalis* (L.) Cr., *Sorbus subfusca* (LDB) Boiss., *Crataegus pentagyna* Waldst. et Kit., and *Carataegus rhipidophylla* Gand., from the Ulmaceae, *Ulmus minor* Mill. and *Ulmus glabra* Huds can be seen. The following species can be found in the sub-forest: from the Rosaceae, *Padus racemose* (Lam.) Gilib., from Cornaceae, and *Cornus mas* L., from the Celastraceae, *Euonymus latifolia* (L.) Mill., from the Oleaceae, *Ligustrum vulgare* L., from the Caprifoliaceae, *Viburnum lantana* L., *Lonicera caucasica* Pall., and from the Rhamnaceae, *Rhamnus cathartica* L., etc.

The grass cover is lighter in forest formations where the participation of *Acer* and *Fraxinus* is rich. In particular, the glades are quite variegated. Here, you can find, from the Rosaceae, *Fragaria viridis* Duch., *Potentilla foliosa* Somm. et Lev., *Potentilla impolita* Wahlenb., *Geum urbanum* L., Lamiaceae, *Marrubium persicum* C.A. Mey, *Lamium amplexicaule* L., *Lamium album* L., *Stachys sylvatica* L., *Stachys iberica* L., and *Origanum Vulgare* L., from the Ranunculaceae, *Delphinium freynii* Conrath, *Delphinium szovitsianum* Boiss), *Anemine caucasica* Willd., *Ranunculus caucasica* M. Bieb, *Ranunculus polyanthemus* L., *Ficaria ficarioides* (Bory et Chaub.) Halaczy), and *Talictum minus* L., from the Scrophulariaceae, *Veronica polita* Fries, *Veronica orientalis* Mill., *Linaria schelkownikowii* Schischk., *Digitalis nervosa* Steud. et Hochst., *Euphrasia pectinate* Ten., *Pedicularis sibthorpii* Boiss., and *Pedicularis wilhelmsiana* Fisch. ex Bieb., from the Convolvulaceae, *Convolvulus cantabrica* L., *Calystegis sylvatica* (Kit.) Griseb, from Asteraceae, *Cichorium intibus* L., *Taraxacum bessarabicum* (Hornem.) Hand. -Mazz., and *Tripleurospermum caucasicum* (Willd.) Hayek, from the Fumariaceae, *Corydalis angustifolia* (M. Bieb.) DC, and *Fumaria vaillantii* Loisl., from the Caryophyllaceae, *Silene dianthoides* Pers., *Silene italica* (L.) Pers., from the Boraginaceae, *Echium vulgare* L., and *Myosotis alpestris* F.W. Schmidt., from the Hyacinthaceae, *Ornithogalum montanum* Cirillo, *Scilla caucasica* Miscz., from the Campanulaceae, *Campanula glomerata* L., *Campanula rapunculoides* L., Hypericaceae, and *Hypericum perforatum* L., and from the Orchidaceae, *Platanthera chlorantha* (Custer) Rchb., *Dactylorhiza urvelleana* (Steud.) H. Baumann et Kunkele, *Dactylorhiza flavescens* (K.Koch) Holub, and *Orchis mascula* (L.) L.) can be found. From the Geraniaceae, *Geranium sylvaticum* L., *Geranium pusillum* L., Primulacea, *Primuls veris* subsp. *macrocalix* (Bunge) Ludi, Malvaceae, *Malva sylvestris* L., Fabaceae - *Vicia truncatula* Fisch., *Vicia grandiflora* Scop., *Lathyrus pratensis* L., *Pisum elatius* M. Bieb., *Trifolium pretense* L., Polygalaceae, *Polygala transcaucasica* Tamamsch., Apiaceae, *Astrantia maxima* Pall., and *Pimpinella rodantha* Boiss. can be found, from the Brassicaceae, *Hesperis matronalis* L., and from the Convallariaceae, *Polygonatum orientale* Desf. can be found, from the Apocynaceae, *Vinca herbacea* Waldst et Kit. is common, etc.

Riverbed forests

A considerable part of the route of the highway, as envisaged by the program (except the tunnel section and right hillsides of the Meghri river gorge) passes along the gorges of the river Voghji first, and then Gozgoz, Meghri, and then along the Meghri valley.

Riverbed forests, with the full understanding of that term, do not exist in Armenia, however, in certain areas, depending on the width of the river watercourse and gorges, forest layers develop on river banks, which vary in



different floristic areas of Armenia, according to their vegetation composition and generate riverbed forest layers.

In riverbed forest layers in the requested area from the Tamaricaceae, *Tamarix Florida* Bunge can be found on the Araks river bank, whereas *Tamarix ramosissima* Ledeb., *Tamarix meyeri* Boiss., and *Tamarix hofenackeri* Bunge. can be found across the barbed wires. *Populus euphratica* Oliv. from the Salicaceae, *Populus nigra* L., *Salix excelsa* S.G. Gmel., *Salix purpurea* L., and *Eleagnus angustifolia* L. from the Eleagnaceae, *Juglans regia* L. from the Juglandaceae, and *Vitis silvestris* C.C. Gmel. from the Vitaceae, can be found on the Araks river valley, etc.

Sparse Forests

Deciduous sparse forests

Deciduous sparse forests have a very abundant vegetation composition. From the *Fagus*, *Quercus iberica* Stev. can be found here, *Quercus araxina* (Trautv.) Grossh. can be found in lower areas, from the Ulmaceae, *Celtis planchoniaca* Waldst. et Kit., *U. minor* Mill., from the Moraceae, *Morus alba* L., from the Aceraceae, *Acer campestre* L., *Acer ibericum* M. Bieb., from the Cornaceae, *Swida australis* (C.A. Mey.) Pojark., from the Eleagnaceae, *Eleagnus angustifolia* L., *Jasminum fruticans* L., from the Caprifoliaceae, *Lonicera iberica* M.Bieb., *Viburnum lantana* L., from the Rosaceae, *Spiraea crenata* L., *Spiraea hypericifolia* L., *Rubus caesius* L., *Rosa spinosissima* L., *Rosa iberica* Stev., *Rosa canina* L., *Cotoneaster integerrima* Medik., *Pyrus salicifolia* Pall., *Pyrus medvedevii* Rubtzov, *Malus orientalis* Uglitzkich, *Mespilus germanica* L., *Crataegus armena* Pojark., *Crataegus orientalis* Pall., *Crataegus meyeri* Pojark., *Prunus spinosa* L., *Prunus divaricate* Ldb., *Amygdalus fenzliana* (Fritsch.) Lipski, *Amygdalus nairica* Frd. et Takht., *Cerasus incana* (Pall.) Spach., and *Cerasus mahaleb* (L.) Mill., from the Anacardiaceae, *Pistacia atlantica* subsp. *mutica* (Fisch. et Mey), from the Berberidaceae, *Berberis orientalis* C. Schneid., from the Grossulariaceae, *Ribes orientale* Dsf., from the Rhamnaceae, *Rhamnus pallasii* Fisch, et C.A. Mey., from the Anacardiaceae, *pistacia*, *Pistacia mtlantica* Desf. subsp. *mutica* (Fisch, et Meyer), *Cotinus cogtgrria* Scop., and *Rhus coriaria* L., etc.

The following species can be found on the grass cover: from the Lamiaceae, *Ajuga chia* Schreb., *Ajuga orientalis* L., *Teucrium orientale* L., *Marrubium persicum* C.A. Mey, *Sideritis montana* (L.), *Sideritis balansae* Boiss., *Stachys sylvatica* L., *Salvia viridis* L., *Salvia sclarea* L., *Thymus fedtschenki* Ronn., Brassicaceae, *Sisymbrium loeselii* L., *Bunias orientalis* L., *Descurainia sofia* (L.) Webb. et Prantl, *Alliaria petiolate* (Bieb.) Cavara et Grande, *Alyssum strictum* Willd., *Thlaspi arvense* L., Fabaceae, and *Vicia narbonensis* L., from the Malvaceae, *Malva neglecta* Wallr., *Alcea tabrisiana* (Boiss. et Bische) Iljin, and *Althea cannabina* L., from the Polygalaceae, *Polygala hohenackeriana* Fisch. et C.A.Mey., from the Rubiaceae, *Asperula prostate* (Adams) K.Koch, *Asperula aparine* M. Bieb, *Galium spurium* L., *Galium verum* L., *Galium coronatum* Sibith. et Smith, and *Rubia tinctorium* L., from the Hyacinthaceae, *Ornithogalum montanum* Cirillo, *Ornithogalum navachinii* Agapova, *Puschkinia scilloides* Adam, *Scilla armena* Grossh., *Muscari tenuiflorum* Tausch, and *Muscari szovitsianum* Baker, from the Caryophyllaceae, *Dianthus ceataceus* Adams., *Dianthus crinitus* Sm, from the Polygonaceae, *Rumex acetosa* L., Hypericaceae,



Hypericum perforatum L., *Hypericum hirsutum* L., and *Hypericum hyssopifolium* Will., from the Resedaceae, *Reseda lutea* L., from the Convolvulaceae, *Convolvulus cantabrica* L., *Campanula rapunculoides* L., from the Liliaceae, *Fritillaria kurdica* Boiss et Noe, *Gagea confusa* A.Terracc, from the Boraginaceae, *Alkanna orientalis* (L.) Boiss., from the Euphorbiaceae, *Euphorbia orientalis* L., *Euphorbia marschaliana* Boiss., and *Euphorbia iberica* Boiss., from the Dipsacaceae, *Dipsacus strigosus* Willd. ex Roem., *Cephalaria gigantea* Ledeb., etc.

Sparse mixed forests

Aside from deciduous sparse forests, sparse mixed forests can be seen in the requested area, as well with the participation of *Juniperus oblonga* M. Bieb, *Juniperus polycarpos* K.Koch, *Juniperus foetidissima* Willd. Here, along with *Juniperus*, you will find representatives of the local sparse forest area – mostly shrubs and types of pulvinaria.

Conifer sparse forests (Juniperus shrubs)

Juniperus sparse forests are formed from one or several species of *Juniperus*. In the requested area, from the Cupressaceae, *Juniperus oblonga* M. Bieb, *Juniperus polycarpos* K.Koch, and *Juniperus foetidissima* Willd. can be found. The main forest-forming species here is *Juniperus polycarpos*. In certain parts, pure *Juniperus* shrubs can be found, where, aside from *Juniperus polycarpos*, *Juniperus oblonga* Bieb and *Juniperus foetidissima* grow in small quantities.

The grass cover of *Juniperus* shrubs is quite rich, where from the Poaceae, *Elytrigia repens* (L.) Nevski, *Taeniatherum crinitum* (Schreb.) Nevski, *Bromus squarrosus* L., *Anisantha tectorum* (L.) Nevski, *Avena persica* Steud., *Poa pratensis* L., *Poa bulbosa* L., *Festuca pratensis* Huds., and *Phleum phleoides* (L.) H. Karsl. can be found. From the Rubiaceae, *Asperula prostate* (Adams) K.Koch, *Galium verum* L., and from the Lamiaceae, *Ajuga chia* Schreb., *Teucrium orientale* L., *Sideritis montana* (L.), and *Scutellaria orientalis* ssp. *karjagini* (Grossh.) Fed., from the Asteraceae, *Hieracium piloselloides* Will., *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz., *Xeranthemum squarrosus* L., *Crupina vulgaris* Cass., and *Senecio taraxacifolius* (M.Bieb.) DC, from the Euphorbiaceae, *Euphorbia iberica* Boiss., from the Iridaceae, *Crocus adamii* J. Gay, from the Scrophulariaceae, *Euphrasia pectinate* Ten., *Pedicularis sibthorpii* Boiss., from the Boraginaceae, *Cerinthe minor* L., *Nonea pulla* (L.) DC, from the Convolvulaceae, *Convolvulus lineatus* L., from the Dipsacaceae, *Dipsacus strigosus* Willd. ex Roem., *Scabiosa bipinnata* K.Koch, from the Liliaceae, *Fritillaria kurdica* Boiss. et Noe, from the Malvaceae, *Malva neglecta* Wallr., from the Brassicaceae, *Alyssum tortuosum* Willd., *Alyssum minus* (L.) Rothm., from the Fabaceae, *Lotus caucasica* Kupr., *Coronilla scorpioides* (L.) K.Koch, *Medicago lupulina* L., *Medicago sativa* L., from the Crassulaceae, *Sedum oppositifolium* Sims., etc. can be found.

Shibliak

Shibliak is a phytocenes species that can be found in similar dry sparse forest ecological conditions, where *Paliurus spina-christi* Mill serves as edificatory. Shibliak has a secondary origin – it originates in the place of forests destroyed by humans.



Here, along with *Paliurus spina*, from the Berberidaceae, *Berberis orientalis* C. Schneid., from the Anacardiaceae, *Pistacia atlantica* subsp. *mutica* (Fisch. et Mey) Rech., *Rhus coriaria* L., from the Tamaricaceae, *Tamarix ramosissima* Ledeb., from the Punicaceae, *Punica granatum* L., from the Rhamnaceae, *Rhamnus pallasii* Fisch. et C.A.Mey., from the Rosaceae, *Rosa spinosissima* L., *Rosa iberica* Stev., *Cotoneaster integerrima* Medik., *Cerasus incana* (Pall.) Spach., *Spiraea crenata* L., *Spiraea hypericifolia* L., Moraceae, and *Ficus carica* L., etc. can be found.

The following species can be found on the grass cover: from the Caryophyllaceae, *Agrostemma githago* L., from the Polygonaceae, *Atraphaxis spinosa* L., from the Crassulaceae, *Sedum album* L., *Sedum hispanicum* L., from the Fabaceae, *Colutea cilicica* Boiss. et Bal., *Astragalus cicer* L., *Astragalus aureus* Willd., *Astragalus lagurus* Willd., *Onobrychis radiata* M. Bieb., and *Vicia truncatula* Fisch., from the Euphorbiaceae, *Euphorbia orientalis* L., *Euphorbia iberica* Boiss., from the Thymelaeaceae, *Thymelaea passerine* (L.) Coss et Germ., from the Asteraceae, *Cichorium intibus* L., *Scorzonera rigida* Auch. ex DC, *Trapogon sosnowskyi* Kuthath., *Cousinia meghrica* Takht., *Hieracium murorum* L., *Crepis pannonica* (Jacq.) K.Koch, *Echinops sphareocephalus* L., *Arctium lappa* L., *Carduus hamulosus* Ehrh., *Cirsium osseticum*(Adam.) Petrak., *Centaurea solstitialis* L., *Crupina vulgaris* Cass., *Senecio taraxacifolius* (M.Bieb.) DC, *Inula germanica* L., *Achillea biebersteinii* Afan., *Achillea vermicularis* Trin., *Tanacetum argrophyllum* (K.Koch) Tzvel., *Artemisia splendens* Willd., *Helichrysum graveolens* (M.Bieb.) Sweet., *Helichrysum pilcatum* DC, *Inula mariae* Bordz., and *Anthemis triumfettii* (L.) All., from the Brassicaceae, *Alyssum alyssoides* (L.) L., *Fibidia clypeata* (L.) Medic., from the Liliaceae, *Tulipa flornskyi* Woronov, *Fritillaria kurdica* Boiss et Noe, *Gagea helenae* Grossh., and *Gagea anisanthos* K.Koch, and from the Dipsacaceae, *Scabiosa bipinnata* K.Koch, etc.

Drought-tolerant – phryganoid vegetation for mountains

Tragacanth shrubs

Sections of tragacanth shrubs can be found in the requested area where *Astragalus aureus* W., serves as edification. The main types of species identified on the grass cover are mostly drought-tolerant plants. Those include: *Nigella arvensis* L. from the Ranunculaceae, *Fumaria asepsala* Boiss. from the Fumariaceae, *Herniaria incana* Lam., *Arenaria dianthoides* Smitt., *Paronychia kurdica* Boiss., *Telephium orientale* Boiss., and *Dianthus crinitus* Sm from the Caryophyllaceae, *Potentilla impolita* Wahlenb., *Alchemilla grossheimii* Juz., *Agrimonia eupatoria* L., and *Poterium polygamum* Waldst. et Kit. from the Rosaceae, *Sedum hispanicum* L. from the Crassulaceae, *Trifolium repens* L., *Trifolium campestre* Schreb. in Sturm., *Onobrychis radiata* M. Bieb., Hypericaceae, and *Hypericum scabrum* L. from the Fabaceae, *Sisymbrium loeselii* L., *Descurainia sofia* (L.) Webb. et Prantl, *Alyssum tortuosum* Willd., and *Alyssum strictum* Willd. from the Brassicaceae, *Grommium verum* L. from the Rubiaceae, *Scabiosa bipinnata* K.Koch from the Dipsacaceae, *Myosotis sparsiflora* Pohl., *Cerinthe minor* L., Lamiaceae, *Ajuga chia* Schreb., *Teucrium polium* L., *Scutellaria orientalis* ssp. *karjaginii* (Grossh.) Fed., *Stachys iberica* L., *Ziziphora capitata* L., and *Ziziphora clinopodioides* Lam. From the Boraginaceae, *Carlina vulgaris* L., *Cousinia erivanensis* Bornm, *Senecio taraxacifolius* (M.Bieb.) DC, and *Achillea vermicularis* Trin. from Asteraceae, and *Koeleria macrantha* (Ledeb.) Schult., *Avena persica* Steud., *Poa pratensis* L., *Poa bulbosa* L., (*Phleum pratense* L.), from *Bromus squarrosus* L., etc.



Mountain xerophytic scrubs

Sections of mountain xerophyte vegetation can be found on the mountain slopes which have a rich plant composition. These sections follow the forests and sparse forests along the road.

From the representatives of dendroflora, the following species can be found here: *Spiraea crenata* L., *Spiraea hypericifolia* L. from the Rosaceae, the shrubs of which seem to paint the slopes with white color during the blooming season. From the Rosaceae, *Rosa spinosissima* L., *Cotoneaster integerrima* Medik., *Amygdalus fenzliana* (Fritsch) Lipsky, *Amygdalus nairica* Fed. et Takht., and Anacardiaceae can also be found here, as well as *Pistacia mtlantica* Desf. subsp. *mutica* (Fisch, et Meyer), *Cotinus cogtgria* Scop., etc. From the Berberidaceae, *Berberis orientalis* C. Schneid and, from the Oleaceae, *Jasminum fruticans* L., etc. can also be found on dry slopes and shrubs.

From herbs, from the Ranunculaceae here we can find *Nigella arvensis* L., *Ranunculus arvensis* L., *Ceratocephalus falcatus* (L.) Pers., from the Papaveraceae, *Glaucium corniculatum* (L.) Curt, *Papaver fugax* Poir, and *Papaver macrostomum* Boiss. et Heth, from the Apiaceae, *Eryngium billardieri* Delar., *Chaerophyllum macrospermum* (Willd. ex Spreng.) Fisch. et C.A. Mey., *Chaerophyllum bulbosum* L., *Scandix aucheri* Boiss., *Hyppomarathrum microcarpum* (M.Bieb.) V. Petrov, *Prangos ferulacea* (L.) Lindl., and *Falcaria vulgaris* Bernh., *Carum carvi* L., from the Fabaceae, *Ononis arvensis* L., *Trigonella arcuate* Mey., *Medicago lupulina* L., *Medicago coerulea* Less. in Ledeb., *Melilotus officinalis* (L.) Desr., *Trifolium repens* L., *Trifolium arvense* L., *Coronilla coronate* L., *Coronilla scorpioides* (L.) K.Koch, *Onobrychis atropatana* Boiss., *Onobrychis radiata* M. Bieb., *Vicia sativa* L., and *Astragalus aegobromus* Boiss. et Hohen. (= *Astragalus torrentum* Bundinge), from the Lamiaceae, *Ajuga chia* Schreb., *Teucrium polium* L., *Scutellaria orientalis* L., *Sideritis balansae* Boiss., *Nepeta mussinii* Spreng., *Stachys iberica* L., *Salvia viridis* L., *Ziziphora capitata* L., *Saturea hortensis* L., and *Thymus kotschyanus* Boiss. et Hohen, from the Asteraceae, *Cichorium intibus* L., *Scorzonera rigida* Auch. ex DC, *Trapogon sosnowskyi* Kuthath., *Hieracium murorum* L., *Crepis pannonica* (Jacq.), *Crepis sancta* (L.) Babc., *Echinops sphareocephalus* L., *Xeranthemum squarrosum* L., *Carlina vulgaris* L., *Cirsium vulgare* (Savi) Ten., *Centaurea iberica* Trev. ex Spreng, *Centaurea solstitialis* L., *Cousinia meghrica* Takht., *Cousinia erivanensis* Bornm., *Crupina vulgaris* Cass., *Senecio vernalis* Waldst. et Kit., *Helichrysum graveolens* (M.Bieb.) Sweet., *Tanacetum argyrophyllum* (K.Koch) Tzvel., *Achyllea biebersteinii* Afan., and *Artemisia splendens* Willd., from the Poaceae, *Brachypodium sylvaticum* (Huds.) P. Beauv., *Trachinia distachya* (L.) Link., *Elytrigia armena* (Nevski) Nevski, *Aegilops triaristata* Willd., *Bromus squarrosus* L., *Anisantha tectorum* (L.) Nevski, *Anisantha rubens* (L.) Nevski, *Avena persica* Steud., *Trisetum rigidum* (M.Bieb) Roem. et Schult., *Koeleria macrantha* (Ledeb.) Schult., *Milium vernale* M.Bieb., *Agrostis capillaris* L., *Agrostis stolonifera* L., *Lolium perenne* L., *Festuca pratensis* Huds., *Poa nemoralis* L., *Phleum paniculatum* Huds., *Melica transsilvanica* Schur., *Melica taurica* K.Koch, *Stipa capillata* L., *Stipa arabica* Trin. et Rupr., *Erianthus ravennae* (L.) P.Beauv., and *Bothrichloa ischaemum* (L.) Keng., from the Rosaceae, *Filipendula hexapetala* Gilib., *Alchemilla sericea* Willd., *Alchemilla grossheimii* Juz., and *Poterium polygamum* Waldst. et Kit., from the Brassicaceae, *Sisymbrium loeselii* L., *Rorippa islandica* (Oeder) Borbas, *Alyssum tortuosum* Willd., *Alyssum strictum* Willd., and *Thlaspi arvense* L., from the Boraginaceae, *Lithospermum arvense* L., *Onosma microcarpa* Stev. ex DC, *Cerinthe minor* L., and *Echium vulgare* L., from the Iridaceae, *Crocus adamii* J. Gay,



Crocus speciosus M.Bieb., *Iris imbricate* Lindl., *Iris paradoxa* Steven, *Gladiolus atrovioleaceus* Boiss., from the Ixioliriaceae, *Ixilirion tataricum* (Pall.) Herb., from the Liliaceae, *Fritillaria kurdica* Boiss. et Noe, from the Linaceae, *Linum tenuifolium* L., from the Convolvulaceae, *Convolvulus lineatus* L., from the Scrophulariaceae, *Verbascum orientale* (L.) All., *Verbascum flavidum* (Boiss.) Freyn et Bornm, *Veronica persica* Poir., *Veronica multifida* L., *Linaria Schelkownikowii* Schischk., *Euphrasia pectinate* Ten., and *Pedicularis sibthorpii* Boiss., from the Rubiaceae, *Asperula prostate* (Adams) K.Koch, *Galium vernum* Scop., from the Solanaceae, *Hyoscyamus niger* L., from the Fumariaceae, *Fumaria asepala* Boiss., *Hypericum scabrum* L., from the Euphorbiaceae, *Euphorbia iberica* Boiss., and from the Alliaceae, *Allium rotundum* L., *Allium flavum* L., etc.

Semi-desert vegetation

Semi-desert vegetation species can be found above the Araks valley – at the foot of sloping hillsides with narrow layers. The main formations include Mugwort semi-deserts with the participation of *Artemisia fragrans* Willd. Salsola semi-deserts can be found in sections, with the participation of *Salsola dendroides* Pall. Here we can also find *Alhagi pseudoalhagi* (M.Bieb.) Desv. from the Fabaceae, *Salsola glauca* M. Bieb., *Salsola pestifer* A.Nelson, *Salsola nodulosa* (Moq.) Iljin, and *Kochia prostrata* (L.) Schrad. from the Chenopodiaceae, *Zygophyllum atriplicoides* Fisch. et C.A. Mey. from the Zygophyllaceae, *Peganum harmala* L. from the Peganaceae, *Scorzonera rigida* Auch. ex DC, *Hieracium piloselloides* Will., *Xeranthemum squarrosum* L., *Centaurea solstitialis* L., and *Artemisia fragrans* Willd. from the Asteraceae, *Atraphaxis spinosa* L. from the Polygonaceae, *Sisymbrium loeselii* L., *Descurainia sofia* (L.) Webb. et Prantl, *Alyssum tortuosum* Willd., and *Thlaspi arvense* L. from the Brassicaceae, and *Elytrigia repens* (L.) Nevski, *Taeniatherum crinitum* (Schreb.) Nevski, *Bromus squarrosus* L., *Anisantha tectorum* (L.) Nevski, *Koeleria macrantha* (Ledeb.) Schult., *Apera interrupta* (L.) P. Beauv., *Agrostis stolonifera* L., *Festuca valesiaca* Gaudin, *Eremopoa persica* (Trin.) Roshev., and *Cynodon dactilin* (L.) Pers. from the Poaceae, etc.

Intrazonal Vegetation

Wetland Vegetation

Coastal Vegetation

There are no lakes and ponds in the requested area, however, the rivers of Voghji and Meghri, as well as their tributaries flow in the area, the banks of which are rich in mesophilic vegetation, there are also super-wet lowlands in the area. From the Typhaceae, *Typha latifolia* L., *Typha laxamii* Lepech. can be found, in the area between the towns of Meghri and Agarak, *Typha dominigensis* (Pers.) Poir. ex Steud., from the Cyperaceae, *Cyperus longus* L., *Torulium caucasicum* Pall., from the Equisetaceae, *Equisetum arvense* L., from the Ranunculaceae, *Clematis orientalis* L., *Ranunculus arvensis* L., from the Rosaceae, *Filipendula ulmaria* (L.) Maxim., also *Rubus anatolicus* Focke. From the Saxifragaceae, *Saxifraga cymbalaria* L., from the Fabaceae, *Lathyrus cicero* L., from the Urticaceae, *Urtica dioica* L., from the Cucurbitaceae, *Brionia dioica* Jacq., from the



Lythraceae, *Lythrum salicaria* L., from the Onagraceae, *Epilobium hirsutum* L., *Epilobium confusum* (Hauskn.), *Chamaenerion angustifolium* (L.) Scop., from the Vitaceae, *Vitis silvestris* C.C.Gmel., Lamiaceae, *Lamium album* L., and *Mentha longifolia* (L.) L., from the Juncaceae, *Juncus effuses* L., *Juncus compressus* Jacq., from the Brassicaceae, *Arabis mollis* Steven = *Arabis christianii* N. Busch, from the Caprifoliaceae, *Sambucus ebulus* L., from the Poaceae, *Phragmites australis* (Cav.) Trin., from the Asclepiadaceae, *Cynanchum acutum* L., from the Cannabiaceae, *Humulus lupulus* L., and from the Valerianaceae, *Valeriana sisimbriifolia* Vahl., etc. can be found.

Aquatic vegetation

From the Potamogetonaceae, *Potamogeton nutans* L. and from the Butomaceae, *Butomus umbellatus* L. can be found between the residential areas of Meghri and Lehvaz.

Petrophile vegetation

There are no landfalls or rockfalls in the requested area. There are rocks where different plant species grow in the cracks. From the Aspleniaceae, *Ceterach officinarum* DC, from the Ephedraceae, *Ephedra procera* F. et M., from the Caryophyllaceae, *Minuartia oreina* (Mattf.) Schischk., *Paronychia kurdica* Boiss., *Herniaria incana* Lam., *Silene ruprechtii* Schischk., and *Dianthus orientalis* Adams, from the Brassicaceae, *Arabis caucasica* Willd., *Draba bruniifolia* Stev., from the Scrophulariaceae, *Scrophularia rupestris* M.Bieb. ex Willd., and from the Hyacinthaceae, *Scilla mischtschenkoana* and *Grossh* grow on the rocks located at the roadside, towards the crossroad of Lehvaz. From the Crassulaceae, *Sempervivum transcaucasicum* Muirhead, *Sedum caucasicum* (Grossh.) Bor., *Sedum oppositifolium* Sims., *Sedum album* L., and *Sedum hispanicum* L., from the Urticaceae, *Parietaria judaica* Strand., from the Rosaceae, *Cerasus incana* (Stev.) Spach., *Sibbaldia parviflora* Willd., from the Valerianaceae, *Valeriana alliariifolia* Adams., *Valeriana sisimbriifolia* Vahl can be found here. From the Cupressaceae, *Juniperus oblonga* M. Bieb., *Juniperus polycarpus* K.Koch, *Juniperus foetidissima* Willd., from the Fabaceae, *Astragalus prilikoanus* Grossh., from the Asteraceae, *Anthemis triumfettii* (L.) All., from the Lamiaceae, *Nepeta mussinii* Spreng., from the Rhamnaceae, *Rhamnus pallasii* Fisch. et C.A.Mey., from the Brassicaceae, *Descurainia sofia* (L.) Webb. et Prantl, *Alyssum strictum* Willd., *Alyssum tortuosum*, *Sobolevskia clavate* (Boiss.) Fenzl in Tchih., *Isatis steveniana* Trautv., and *Erysimum ibericum* (Adams) DC, and from the Poaceae, *Melica transsilvanica* Schur., *Melica taurica* K.Koch, *Phleum paniculatum* Huds., *Poa nemoralis* L., and *Lolium perenne* L., etc. can also be found in individual on the rocks, outside the *Juniperus* shrubs.

Photos taken in the Kajaran-Agarak section of the North-South highway



Scilla sibirica and *Anemone caucasica*



Viola odorata



Ficaria vernalis



Puschinia scillaoides



Corydalis angustifolia



Tussilago farfara



Hornbeam (*Carpinus*) forest in the region of Syunik



Juniperus oblonga



Papaver fugax



Chamaenerion angustifolium



Helichrysum pilcatum



Astragalus aureus



Jasminum fruticans



Juniperus polycarpos



Coprinus picaceus



Papaver orientale



Delphinium freynii



Digitalis nervosa



Achillea biebersteinii



Silene compacta



Myosotis heteropoda



Scutellaria orientalis



Chorispora tenella



Falcaria vulgaris



Xeranthemum squarrosum



Dryopteris filix-mas



Cerasus incana



Iris imbricate



Diantus orientalis



Thymus kotschyanus



Crocus speciosus



Clematis orientalis



Acer campestre



Fraxinus excelsior



Quercus macranthera



Pistacia atlantica subsp. *Mutica*



Cotoneaster integrerrima



Dactylorhiza flavescens



Aegilops cylindrical



Taeniatherum crinitum



Thymus rariflorus



Marrubium persicum



Sideritis montana



Linum austriacum



Helichrysum graveolens



Cartaurea solstitialis



Acer campestre



Pyrus syriaca



Nepeta mussinii



Veronica multifida



Dactylorhiza flavescens

Scilla siberica Haw



Astragalus prilipkoanus

Vicia grandiflora



Ornithogalum montanum



Valeriana alliariifolia Adams



Hesperis



Alkanna orientalis



Fibigia clypeata



Valeriana sisymbriifolia Vahl



Sedum oppositifolium



Calystegia silvatica



Arum conophalloides Kotschy ex Schott



Alcea flavovirens



White oak (*Quercus alba*) and Hornbeam deciduous forest in Lichk.



The valley of the Voghji river, near the village of Lernadzor, from where the route starts.



FAUNA

The study area spanned all sections of the territory designated by the Kajaran-Agarak road project of the North-South highway. The proposed highway mainly runs along the floodplains of the Voghji and Meghri rivers. The first section of the road up until the tunnel started just above the old tailing dump located in the floodplain of the Voghji River at elevation of about 1500 m. The entire section runs primarily along the left bank of the river. Before reaching the village of Lernadzor, the road turns right and after crossing the river enters the projected tunnel which is over 7 km long. The right side of the road is mostly rocky slopes with phryganoid vegetation. Some places are represented with small patches of dry open woodlands and herbal grass communities. At the intersection of the Voghji River, the new road will cross small private orchards with fruit trees and a riverbed strip of willow thickets. The area near the entrance to the tunnel includes small patches with tree shrubs cover.

The tunnel exit is located in the floodplains of Meghri River. Essentially, the entire proposed road is located in the floodplains of the river which sometimes retreats left or right.

All along its length the road crosses areas with broad-leaved forest cover, hillsides with xerophilic vegetation, open juniper woodlands and patches of steppic grass vegetation. The hillsides get drier further towards the lower reaches of the Araks river. Shortly before the entrance of the second tunnel, the road intersects a large swath of broad-leaved forest and after leaving the tunnel it keeps crossing another small patch of forest, then dry open woodland and mountain hillsides with xerophytic vegetation. All the way through to the town of Meghri the road repeatedly crosses the Meghri River, occasionally passing through the riverbeds of willow forest, shrubby thickets, strips of private orchards and gardens of local residents. Before reaching the Meghri town the projected road circumvents it and runs across the rocky slopes with open juniper tree growth and friganoid vegetation. After skirting the town, the road joins the old highway, crosses several orchards and, cutting through a section of the old road again turns in the direction of Agarak. The remainder of the road passes through a semi-desert landscape with scanty semi-desert vegetation on its right side and a dense riparian forest on the left side.

After leaving the main large tunnel, the road crosses a fairly large section of the territory of Arevik National Park running through a broad-leaved forest area with rocky outcrops. Then further all along its length, the projected road again crosses small sections of Arevik National Park or runs directly parallel its boundaries.

All of the above-specified landscape habitat has determined the diversity of vertebrate species inhabiting the territory of the projected Kajaran-Agarak highway.

Materials and methodology

The material used in this report was collected from the literature sources and derived from data collected during the field visits to the territory of the proposed road project and landfill sites.

Before the start of this research work all available scientific information related to this region in one way or another (literature sources, various reports, scientific collection fund of the Institute of Zoology) has been treated and reviewed. In the course of reviewing the available literary resources (Dahl S.K. 1954, Geptner V.G. et al. 1967., Martirosyan B.A., Papanyan S.B. 1983, Bibikov D.I. 1985, Aghajanyan F.S. 1986, Aghababyan K.E. 1998, Ghasabyan M.G., 1985, 2001, Popov G. Yu. 2003, Avagyan A.V. 2010, Aghasyan A.L. 1985,1986, Aghasyan et. al 2013, Darevsky I.S. 1957, 1975, Tuniev B.S. et al 2009, Adamian M.S. and Klem D. Jr. 1999, L A. Leister A. F., Sosnin G. V. 1942, the Red Data Book of Armenia 1987, 2010; ASPB reports on the Important Bird



Areas IBAs (<http://datazone.birdlife.org/site/factsheet/lake-sevan-and-environs-iba-armenia>) we also used preliminary data contained in the Emerald “Network” Sites of the Republic of Armenia from 2016 and the Management Plan of Arevik National Park.

Based on the above, we have drawn up a preliminary list of vertebrate species which are likely to occur in this area and were observed during our field surveys (Tab 1, 2, 3). The table showing the bird list also shows the occurrence status of the species. All tables show species included in the IUCN Red List and the Red Data Book of Armenia.

We used line transect surveys to estimate the abundance and species richness of vertebrate populations according to accepted standardized methods for monitoring terrestrial animals (Formozov 1951, 1976; Novikov 1953; Oshmarin P.G., 1990).

Sightings of vertebrates in the wild are mostly incidental, their traces of vital activities though are much more frequently observed. During the line transect sampling, we recorded direct visual sightings of species and the following traces of activities of mammals and birds:

- 1) Animal footprints in mud, dirt and sand,
- 2) Tracks related to their foraging activity (gnawed remains and pellets, meal leftovers, etc.),
- 3) Droppings, excrements,
- 4) Refuge (burrows, lairs, lays, colonies, nests).

In addition, along the entire projected highway we have designated stationary vantage points where brief stops were made during transect surveys to observe the activity of birds and reptiles (Figure 59).



Figure 59: Map of stationary vantage points



Observations of birds and other mammalian species documented in the study area were performed using Kite 10x40 binoculars and Kowa 20x40x60 magnifying spotting scope. Bird observation and species identification of the project area was carried out using Collins Bird Guide 2009 and Dick Forsman 2016.

Sightings of birds were largely recorded on the ground "in the field", indicating the location and tie of the sighting (Annex 1). On the basis of these data, maps of distribution of birds on the routes (Figure 60). We have used the android app program of the Observation.org (<https://observation.org>) website.

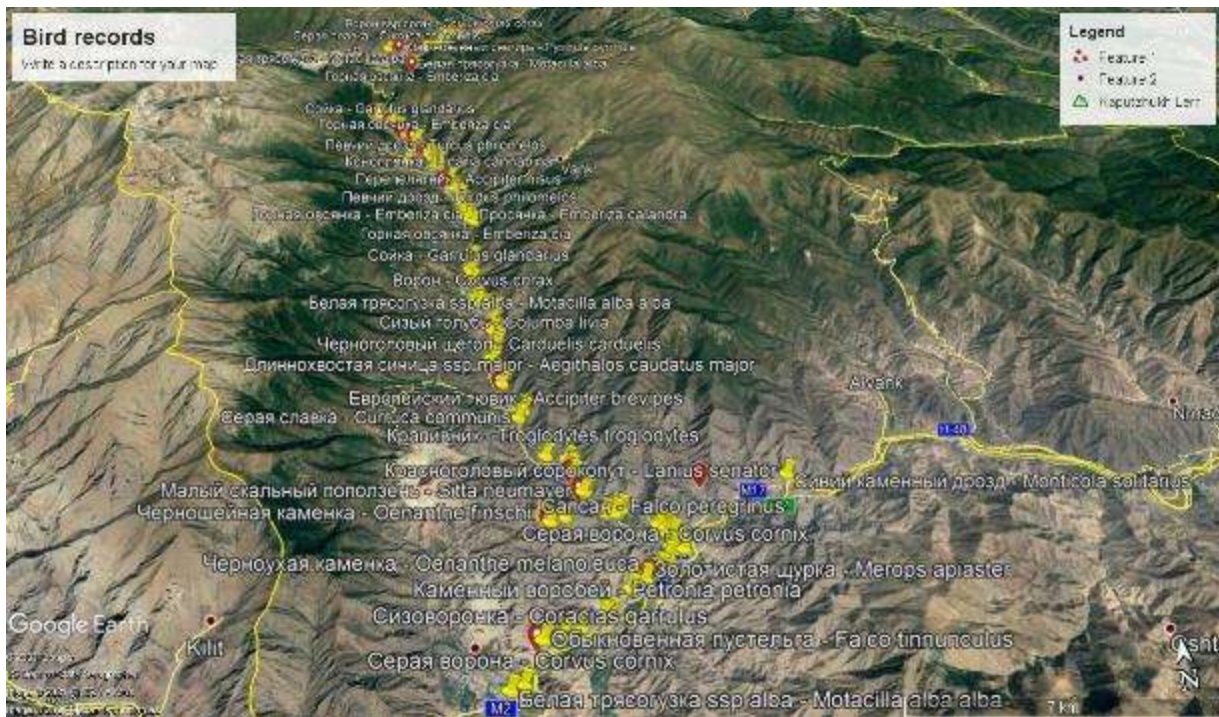


Figure 60: Map of geolocated bird observations

The species status and criteria were determined using the criteria contained in the Trust for Ornithology’s Bird Atlas (Table 26) published by the British Trust for Ornithology for 2007-2011 years which were slightly modified and adapted to local project needs.

Table 26: Survey criteria used for determining breeding status of birds

Non-breeding
Species flying over
Species observed but suspected to be still on migration
Species observed but suspected to be summering non-breeder



Species observed hunting/feeding but suspected to breed in another square (or outside of study area)
Possible breeder
Species observed in breeding season in suitable nesting habitat
Singing male present in suitable breeding habitat
Probable breeding
Pair observed in suitable nesting habitat in breeding season
Permanent territory presumed through registration of territorial behavior (song, etc.) on at least two different days a week or more apart at the same place
Bird visiting probable nest site
Agitated behavior or anxiety calls from adults
Nest building or excavating nest-hole
Courtship and display in or near potential breeding habitat
Confirmed breeding
Nest building
Adults entering or leaving nest-site in circumstances indicating occupied Nest
Recently fledged young (nidicolous species) or downy young (nidifugous species)
Adult carrying faecal sac or food for young
Nest containing eggs or young

Fish species in Meghri and Voghji rivers

Meghri

Onchorhynchus mykiss, Rainbow trout – formed in the area as a result of fishery management

Salmo trutta, Sea trout - identified in the upper reaches and tributaries of the Meghri river

Carassius gibelio, Prussian carp

Capoeta capoeta, Caucasian scraper

Barbus cyri, Kura berbel

Alburnoides eichwaldii, Kura chub

Voghji

Onchorhynchus mykiss, Rainbow trout – formed in the area as a result of fishery management

Salmo trutta, Sea trout - was identified in the upper part of the Voghji River before reaching Kajaran

Carassius gibelio, Prussian carp

Capoeta capoeta, Caucasian scraper

Barbus cyri, Kura berbel



Alburnoides eichwaldii, Kura chub

Oxyndemacheilus bergianus, Kura sportive loach

Birds

Based on the literature data and data collected during our visits to the territory of the proposed road, we drew up a table (Table 27) which includes the species of birds with a high likelihood of occurrence in the project territory and in its immediate vicinity. Relevance of the habitat type and quality characteristic of each species (forest, shrubs, rock boulders, rocky outcrops, water and wetland areas, arable agricultural land, etc.) served as selection basis for proposing species as possibly occurring on the territory. Bird species both actually documented during our field surveys and those thought to occur in the area are listed in the table according to their occurrence status in Armenia, as well as in the road construction assessment area.

By examining data in the table, we can see those birds belonging to 149 species and 41 families occur along the entire roadway. Passerines are the most abundant group, which are followed by the next abundant group of Birds of Prey. It is worth noting that apart from being abundant, passerine birds are also the most frequent breeders along the entire length of the proposed road. Their nesting is confined to all habitat landscapes that are expected to be crossed by the highway - from forest zone all the way up to the entrance of the tunnel and after exiting from it. Also, the density of passerine birds increases in the area near the crossing point with the village of Lichk-Tashtun, where the new road will pass through the wooded hillside of the gorge and will run until the entrance of the second tunnel. From the point near the exit of the second tunnel and further down below the summer homes, which the proposed new road is going to skirt on its right side, the species composition of passerines begins to change.

Species inhabiting forest belt and meadows such as Wood Lark, Tree Pipit, Hedge Accentor, Eurasian Bullfinch, Whinchat, Coal Tit, Great Tit, Eurasian Blackbird, European Greenfinch and others are replaced with the birds typical of more arid habitats which include Ring Ouzel, Common Woodpigeon, Rock Bunting, Red-fronted Serin, Common Redstart, Mountain Chiffchaff, European Robin. Small patches of hayfields and grasslands in the forested area provide refuge to species which are very rare in these habitats - Grey Partridge and Common Quail.

The lower the road elevation, the higher is the number of species which resort to open juniper woodlands and mountain steppe hillsides with shrubby vegetation, these include Syrian Woodpecker, Grey Wagtail, Rufous-tailed Rock-thrush, Blue Rock-thrush, Upcher's Warbler, Common Whitethroat, Blue Tit, Western Rock-nuthatch, European Goldfinch, Black-headed Bunting.

And, finally, the lowest section of the road running through the semidesert landscape supports species which thrive in dry and waterless habitats. These include almost all species of wheatears, European Bee-eater, Woodchat Shrike, Pale Rock Sparrow. These arid areas also provide refuge for some gallinaceous such as Chukar and extremely rare See-see Partridge and Black Francolin.

White-throated Dipper was observed feeding on stones in the Meghri River below the village of Vardanidzor, and Cetti's Warbler, Winter Wren, Garden Warbler and Mountain Chiffchaff have been spotted in willow thickets along the river banks. Extensive fruit orchards were laden with Orphean Warbler, Common Whitethroat, Spotted Flycatcher, and Eurasian Tree Sparrow.



All species in the Corvidae group except for Yellow-billed Chough were observed along the entire road transect. A pair of Yellow-billed Chough has been spotted once being perched on a hillside near the entrance of the big tunnel.

Out of a large number of birds of prey recorded in the assessment area for the proposed highway, two species were recorded breeding – Levan Sparrowhawk nesting in mature stands of hazelnut tree which grows along the Meghri River and Common Kestrel inhabiting rocky habitats. Other birds of prey have been observed in flight soaring high over the assessment area scanning the hillsides around the highway in search of food.

Among the species of waterbird fauna shown in the table, Little Bittern was the only species observed with a fledged juvenile down the course of the Meghri river, below Meghri town. Little Ringed Plover and Common Moorhen were spotted running across the highway towards the banks of the Araks river at the intersection with town Agarak. Other members of this group mostly spend their winter on the Araks river and may fly parallel the highway or cross it over from time to time.

Examining the data further, we discovered that out of 149 species featured in the table, 142 breed in Armenia, while only 90 species do in the project assessment area. The occurrence status for 16 bird species thought to occur in the territory could not be determined because no information related to these birds were found in the literature sources and their breeding status also could not get confirmed as no evidence of breeding was recorded during our field studies.

Out of all species possibly occurring in the assessment area, 6 species are included in the IUCN Red List of Globally Threatened Species and 28 species are listed in the Armenian Red Book of Animals. European Turtle-dove is not listed in the national Red Data Book because it was not on the IUCN Red List at the time of its compilation. The remaining 23 species included in the IUCN Red List are classified as Least Concern (LC).

Of all the red-listed species in the region, 19 species do not breed in the study area. Nine species are reliably nesting, and the nesting of one - Eurasian Eagle-owl is not confirmed.

9 species have confirmed breeding records and one species breeding – Eurasian Eagle Owl is unconfirmed.

Table 27: Bird checklist

No.	Common Name	Scientific Name	1	2	3
Phalacrocoracidae					
1.	Great Cormorant	Phalacrocorax carbo	br	nbr	LC vu
Ardeidae					
2.	Common Little Bittern	Ixobrychus minutus	br	br	
Anatidae					
3.	Gadwall	Mareca strepera	br	nbr	
4.	Common Teal	Anas crecca	nbr	nbr	
5.	Mallard	Anas platyrhynchos	br	nbr	
6.	Garganey	Spatula querquedula	br	nbr	



7.	Common Merganser	Mergus merganser	nbr	nbr	
Accipitridae					
8.	European Honey-buzzard	Pernis apivorus	br	nbr	
9.	White-tailed Sea Eagle	Haliaeetus albicilla	nbr	nbr	LC en
10.	Lammergeier	Gypaetus barbatus	br	nbr	NT vu
11.	Egyptian Vulture	Neophron percnopterus	br	nbr	EN en
12.	Griffon Vulture	Gyps fulvus	br	nbr	LC vu
13.	Cinereous Vulture	Aegyptius monachus	br	nbr	NT en
14.	Short-toed Snake-eagle	Circaetus gallicus	br	nbr	LC vu
15.	Hen Harrier	Circus cyaneus	nbr	nbr	
16.	Northern Goshawk	Accipiter gentilis	br	nbr	LC vu
17.	Eurasian Sparrowhawk	Accipiter nisus	br	nbr	
18.	Shikra	Accipiter badius	br	?	
19.	Levant Sparrowhawk	Accipiter brevipes	br	br	LC vu
20.	Eurasian Buzzard	Buteo buteo	br	nbr	
21.	Long-legged Buzzard	Buteo rufinus	br	nbr	
22.	Eastern Imperial Eagle	Aquila heliaca	nbr	nbr	VU vu
23.	Golden Eagle	Aquila chrysaetos	br	nbr	LC vu
24.	Booted Eagle	Hieraaetus pennatus	br	nbr	LC vu
Falconidae					
25.	Lesser Kestrel	Falco naumanni	br	nbr	LC vu
26.	Common Kestrel	Falco tinnunculus	br	br	
27.	Red-footed falcon	Falco vespertinus	br	nbr	NT vu
28.	Eurasian Hobby	Falco subbuteo	br	nbr	
29.	Peregrine Falcon	Falco peregrinus	br	nbr	LC vu
Phasianidae					
30.	Chukar	Alectoris chukar	br	br	
31.	See-see Partridge	Ammoperdix griseogularis	br	nbr	LC vu
32.	Black Francolin	Francolinus francolinus	br	nbr	LC DD
33.	Grey Partridge	Perdix perdix	br	br	
34.	Common Quail	Coturnix coturnix	br	br	
35.	Common Pheasant	Phasianus colchicus	br	nbr	LC DD
Rallidae					
36.	Common Moorhen	Gallinula chloropus	br	nbr	
Charadriidae					
37.	Little Ringed Plover	Charadrius dubius	br	br	
Scolopacidae					
38.	Eurasian Woodcock	Scolopax rusticola	br	br	



Laridae					
39.	Armenian Gull	Larus armenicus	br	nbr	NT vu
Columbidae					
40.	Rock Pigeon	Columba livia	br	br	
41.	Common Woodpigeon	Columba palumbus	br	br	
42.	Eurasian Collared-dove	Streptopelia decaocto	br	br	
43.	European Turtle-dove	Streptopelia turtur	br	br	VU -
44.	Laughing Dove	Spilopelia senegalensis	br	br	
Cuculidae					
45.	Common Cuckoo	Cuculus canorus	br	br	
Strigidae					
46.	Common Scops-owl	Otus scops	br	br	
47.	Eurasian Eagle-owl	Bubo bubo	br	?	LC vu
48.	Tawny Owl	Strix aluco	br	?	
49.	Northern Long-eared Owl	Asio otus	br	?	
Caprimulgidae					
50.	Eurasian Nightjar	Caprimulgus europaeus	br	br	
Apodidae					
51.	Alpine Swift	Tachymarptis melba	br	nbr	
52.	Common Swift	Apus apus	br	nbr	
Alcedinidae					
53.	Common Kingfisher	Alcedo atthis	br	br	
Meropidae					
54.	European Bee-eater	Merops apiaster	br	br	
Coraciidae					
55.	European Roller	Coracias garrulus	br	br	LC vu
Upupidae					
56.	Eurasian Hoopoe	Upupa epops	br	br	
Picidae					
57.	Eurasian Green Woodpecker	Picus viridis	br	br	
58.	Great Spotted Woodpecker	Dendrocopos major	br	br	
59.	Syrian Woodpecker	Dendrocopos syriacus	br	br	
Alaudidae					
60.	Crested Lark	Galerida cristata	br	br	
61.	Wood Lark	Lullula arborea	br	br	
62.	Eurasian Skylark	Alauda arvensis	br	nbr	
63.	Horned Lark	Eremophila alpestris	br	nbr	



Hirundinidae					
64.	Eurasian Crag-martin	Hirundo rupestris	br	nbr	
65.	Northern House-martin	Delichon urbicum	br	nbr	
Motacillidae					
66.	Tawny Pipit	Anthus campestris	br	nbr	
67.	Tree Pipit	Anthus trivialis	br	nbr	
68.	Water Pipit	Anthus spinoletta	br	nbr	
69.	Yellow Wagtail	Motacilla flava	br	?	
70.	Grey Wagtail	Motacilla cinerea	br	br	
71.	White Wagtail	Motacilla alba	br	br	
Cinclidae					
72.	White-throated Dipper	Cinclus cinclus	br	br	
Troglodytidae					
73.	Winter Wren	Troglodytes troglodytes	br	br	
Prunellidae					
74.	Hedge Accentor	Prunella modularis	br	br	
Muscicapidae					
75.	Rufous-tailed Scrub-robin	Erythropygia galactotes	br	?	
76.	European Robin	Erithacus rubecula	br	br	
77.	Thrush Nightingale	Luscinia luscinia	br	br	
78.	Common Nightingale	Luscinia megarhynchos	br	?	
79.	Bluethroat	Luscinia svecica	br	nbr	
80.	White-throated Robin	Irania gutturalis	br	br	LC dd
81.	Black Redstart	Phoenicurus ochruros	br	br	
82.	Common Redstart	Phoenicurus phoenicurus	br	br	
83.	Whinchat	Saxicola rubetra	br	br	
84.	Common Stonechat	Saxicola torquatus	br	br	
85.	Isabelline Wheatear	Oenanthe isabellina	br	br	
86.	Northern Wheatear	Oenanthe oenanthe	br	br	
87.	Black-eared Wheatear	Oenanthe hispanica	br	br	
88.	Finsch's Wheatear	Oenanthe finschii	br	br	
89.	Red-tailed Wheatear	Oenanthe chrysopygia	br	br	LC en
90.	Rufous-tailed Rock-thrush	Monticola saxatilis	br	br	
91.	Blue Rock-thrush	Monticola solitarius	br	br	
Turdidae					
92.	Ring Ouzel	Turdus torquatus	br	br	
93.	Eurasian Blackbird	Turdus merula	br	br	
94.	Mistle Thrush	Turdus viscivorus	br	br	
Sylviidae					



95.	Cetti's Warbler	Cettia cetti	br	br	
96.	Great Reed-warbler	Acrocephalus arundinaceus	br	?	
97.	Olivaceous Warbler	Hippolais pallida	br	br	
98.	Upcher's Warbler	Hippolais languida	br	br	
99.	Menetries's Warbler	Sylvia mystacea	br	br	
100.	Orphean Warbler	Sylvia hortensis	br	?	
101.	Lesser Whitethroat	Sylvia curruca	br	?	
102.	Common Whitethroat	Sylvia communis	br	br	
103.	Garden Warbler	Sylvia borin	br	?	
104.	Blackcap	Sylvia atricapilla	br	?	
105.	Greenish Warbler	Phylloscopus trochiloides	br	br	
106.	Mountain Chiffchaff	Phylloscopus sindianus	br	br	
107.	Common Chiffchaff	Phylloscopus collybita	br	?	
108.	Spotted Flycatcher	Muscicapa striata	br	br	
Aegithalidae					
109.	Long-tailed Tit	Aegithalos caudatus	br	br	
Paridae					
110.	Sombre Tit	Parus lugubris	br	br	LC vu
111.	Coal Tit	Periparus ater	br	br	
112.	Blue Tit	Cyanistes caeruleus	br	br	
113.	Great Tit	Parus major	br	br	
Sittidae					
114.	Wood Nuthatch	Sitta europaea	br	br	
115.	Eastern Rock-nuthatch	Sitta tephronota	br	br	LC vu
116.	Western Rock-nuthatch	Sitta neumayer	br	br	
117.	Wallcreeper	Tichodroma muraria	br	br	LC DD
Certhiidae					
118.	Eurasian Treecreeper	Certhia familiaris	br	br	
Oriolidae					
119.	Eurasian Golden Oriole	Oriolus oriolus	br	br	
Laniidae					
120.	Red-backed Shrike	Lanius collurio	br	br	
121.	Lesser Grey Shrike	Lanius minor	br	br	
122.	Great Grey Shrike	Lanius excubitor	nbr	nbr	
123.	Woodchat Shrike	Lanius senator	br	br	LC vu
Pycnonotidae					
124.	White-eared bulbul	Pycnonotus leucotis	br	?	
Corvidae					



125.	Eurasian Jay	Garrulus glandarius	br	br	
126.	Black-billed Magpie	Pica pica	br	br	
127.	Yellow-billed Chough	Pyrrhonorax graculus	br	nbr	LC en
128.	Red-billed Chough	Pyrrhonorax pyrrhonorax	br	br	
129.	Hooded Crow	Corvus corone	br	br	
130.	Common Raven	Corvus corax	br	br	
Sturnidae					
131.	Common Starling	Sturnus vulgaris	br	br	
132.	Rosy Starling	Sturnus roseus	br	?	
Passeridae					
133.	House Sparrow	Passer domesticus	br	br	
134.	Eurasian Tree Sparrow	Passer montanus	br	br	
135.	Pale Rock Sparrow	Petronia brachydactyla	br	br	
136.	Rock Sparrow	Petronia petronia	br	br	
Fringillidae					
137.	Eurasian Chaffinch	Fringilla coelebs	br	br	
138.	Brambling	Fringilla montifringilla	nbr	nbr	
139.	Red-fronted Serin	Serinus pusillus	br	br	
140.	European Greenfinch	Carduelis chloris	br	br	
141.	European Goldfinch	Carduelis carduelis	br	br	
142.	Eurasian Linnet	Carduelis cannabina	br	br	
143.	Twite	Carduelis flavirostris	br	br	
144.	Common Rosefinch	Carpodacus erythrinus	br	br	
145.	Eurasian Bullfinch	Pyrrhula pyrrhula	br	br	
146.	Hawfinch	Coccothraustes coccothraustes	br	?	
Emberizidae					
147.	Rock Bunting	Emberiza cia	br	br	
148.	Black-headed Bunting	Emberiza melanocephala	br	br	
149.	Corn Bunting	Miliaria calandra	br	br	

1. Occurrence status in Armenia
2. Occurrence status in project area

* Species listed in the IUCN Red List and Red Book of Animals of Armenia (highlighted red).

Table 28: List of registered birds

Scientific name	Name	Date	N	X	Y	Visit
Pernis apivorus	European Honey Buzzard	22.04.2021	1	46,19742	39,05503	1
Pica pica	Eurasian Magpie	22.04.2021	1	46,19742	39,05503	1
Buteo buteo	Common Buzzard	22.04.2021	2	46,19742	39,05504	1



Saxicola rubetra	Whinchat	22.04.2021	1	46,19743	39,05504	1
Parus major	Great Tit	22.04.2021	2	46,19741	39,05503	1
Motacilla alba	White Wagtail	22.04.2021	1	46,21285	38,97131	1
Periparus ater	Coal Tit	22.04.2021	2	46,21285	38,97131	1
Troglodytes troglodytes	Eurasian Wren	22.04.2021	1	46,21286	38,97131	1
Columba livia	Rock Dove	22.04.2021	5	46,21289	38,97131	1
Pica pica	Eurasian Magpie	22.04.2021	1	46,21290	38,97131	1
Emberiza cia	Rock Bunting	22.04.2021	3	46,18788	39,12510	1
Motacilla alba	White Wagtail	22.04.2021	1	46,18787	39,12503	1
Motacilla alba	White Wagtail	22.04.2021	1	46,18784	39,12507	1
Tichodroma muraria	Wallcreeper	22.04.2021	1	46,18174	39,14891	1
Pica pica	Eurasian Magpie	22.04.2021	2	46,18238	39,15004	1
Columba livia	Rock Dove	22.04.2021	5	46,18238	39,15005	1
Columba livia	Rock Dove	22.04.2021	1	46,18239	39,15007	1
Motacilla alba	White Wagtail	22.04.2021	1	46,18257	39,15020	1
Troglodytes troglodytes	Eurasian Wren	22.04.2021	1	46,18251	39,15020	1
Emberiza cia	Rock Bunting	22.04.2021	1	46,19644	39,15260	1
Periparus ater	Coal Tit	22.04.2021	1	46,19677	39,15239	1
Phoenicurus phoenicurus	Common Redstart	22.04.2021	2	46,19677	39,15239	1
Parus major	Great Tit	22.04.2021	1	46,19676	39,15239	1
Saxicola rubetra	Whinchat	22.04.2021	1	46,19676	39,15239	1
Motacilla alba	White Wagtail	22.04.2021	1	46,19675	39,15239	1
Periparus ater	Coal Tit	22.04.2021	1	46,20310	39,15963	1
Turdus merula	Common Blackbird	22.04.2021	2	46,20311	39,15964	1
Buteo buteo	Common Buzzard	22.04.2021	1	46,20311	39,15965	1
Motacilla alba	White Wagtail	22.04.2021	1	46,20315	39,15964	1
Emberiza cia	Rock Bunting	22.04.2021	2	46,20318	39,15960	1
Emberiza calandra	Corn Bunting	22.04.2021	2	46,20781	39,16320	1
Pica pica	Eurasian Magpie	22.04.2021	2	46,20781	39,16320	1
Buteo buteo vulpinus	Steppe Buzzard	22.04.2021	2	46,20780	39,16320	1
Emberiza cia	Rock Bunting	22.04.2021	1	46,20777	39,16321	1
Emberiza cia	Rock Bunting	23.04.2021	1	46,18826	39,06913	2
Motacilla cinerea	Grey Wagtail	23.04.2021	1	46,18826	39,06913	2
Turdus merula	Common Blackbird	23.04.2021	2	46,18614	39,06333	2
Gypaetus barbatus barbatus	Bearded Vulture ssp barbatus	23.04.2021	2	46,20173	39,04468	2
Emberiza cia	Rock Bunting	23.04.2021	1	46,20739	39,02120	2
Emberiza cia	Rock Bunting	23.04.2021	1	46,20950	39,01953	2
Emberiza calandra	Corn Bunting	23.04.2021	2	46,20950	39,01953	2
Passer montanus	Eurasian Tree Sparrow	23.04.2021	13	46,21251	38,95912	2



Falco tinnunculus tinnunculus	Common Kestrel ssp tinnunculus	23.04.2021	1	46,21228	38,95939	2
Motacilla flava feldegg	Black-headed Wagtail	23.04.2021	2	46,21228	38,95939	2
Motacilla cinerea	Grey Wagtail	23.04.2021	1	46,21228	38,95939	2
Cettia cetti	Cetti's Warbler	23.04.2021	1	46,21229	38,95938	2
Curruca communis	Common Whitethroat	23.04.2021	2	46,21309	38,96070	2
Corvus corax	Northern Raven	23.04.2021	2	46,21327	38,96099	2
Riparia riparia	Sand Martin	23.04.2021	5	46,21366	38,96234	2
Columba livia	Rock Dove	23.04.2021	4	46,21366	38,96234	2
Emberiza calandra	Corn Bunting	23.04.2021	2	46,21347	38,96380	2
Phoenicurus phoenicurus	Common Redstart	23.04.2021	1	46,21249	38,96701	2
Garrulus glandarius	Eurasian Jay	23.04.2021	1	46,21249	38,96700	2
Motacilla alba	White Wagtail	23.04.2021	1	46,21244	38,96698	2
Luscinia svecica	Bluethroat	23.04.2021	1	46,21186	38,97749	2
Motacilla alba	White Wagtail	23.04.2021	1	46,21202	38,97742	2
Oriolus oriolus	Golden Oriole	23.04.2021	2	46,21222	38,97711	2
Turdus merula	Common Blackbird	23.04.2021	2	46,17639	39,08041	2
Parus major	Great Tit	23.04.2021	1	46,17638	39,08043	2
Parus major	Great Tit	23.04.2021	1	46,17598	39,08130	2
Emberiza cia	Rock Bunting	23.04.2021	2	46,17598	39,08130	2
Garrulus glandarius	Eurasian Jay	23.04.2021	2	46,17598	39,08130	2
Erithacus rubecula	European Robin	23.04.2021	1	46,17381	39,08413	2
Turdus merula	Common Blackbird	23.04.2021	2	46,17093	39,08750	2
Garrulus glandarius	Eurasian Jay	23.04.2021	2	46,17099	39,08750	2
Motacilla alba alba	White Wagtail ssp alba	23.04.2021	1	46,18323	39,14973	2
Corvus corax corax	Raven	23.04.2021	2	46,18328	39,14970	2
Alauda arvensis armenica	Eurasian Skylark	23.04.2021	4	46,18327	39,14970	2
Ptyonoprogne rupestris	Eurasian Crag Martin	23.04.2021	3	46,18335	39,14970	2
Sturnus vulgaris caucasicus	Common Starling	23.04.2021	9	46,18293	39,14951	2
Upupa epops	Eurasian Hoopoe	23.04.2021	2	46,18294	39,14952	2
Delichon urbicum	House Martin	23.04.2021	5	46,18293	39,14951	2
Falco tinnunculus	Common Kestrel	23.04.2021	1	46,18294	39,14950	2
Tichodroma muraria	Wallcreeper	23.04.2021	1	46,18294	39,14948	2
Turdus merula	Common Blackbird	23.04.2021	1	46,18217	39,14898	2
Emberiza cia	Rock Bunting	23.04.2021	2	46,18222	39,14894	2
Picus viridis	European Green Woodpecker	24.04.2021	1	46,20784	39,00134	3
Corvus corax	Northern Raven	24.04.2021	1	46,20749	38,98174	3
Oenanthe hispanica	Western Black-eared Wheatear	24.04.2021	2	46,20749	38,98174	3
Garrulus glandarius	Eurasian Jay	24.04.2021	1	46,21073	38,97795	3



Oenanthe hispanica	Western Black-eared Wheatear	24.04.2021	2	46,21152	38,97733	3
Muscicapa striata	Spotted Flycatcher	24.04.2021	1	46,20813	38,97959	3
Motacilla alba	White Wagtail	24.04.2021	1	46,20813	38,97959	3
Motacilla flava	Western Yellow Wagtail	24.04.2021	1	46,21238	38,97760	3
Cinclus cinclus caucasicus	White-throated Dipper ssp caucasicus	24.04.2021	1	46,21239	38,97763	3
Corvus corax	Northern Raven	24.04.2021	1	46,21474	38,97592	3
Motacilla alba	White Wagtail	24.04.2021	1	46,21474	38,97592	3
Lanius collurio	Red-backed Shrike	24.04.2021	1	46,20623	38,99612	3
Cyanistes caeruleus	Eurasian Blue Tit	24.04.2021	1	46,20623	38,99612	3
Emberiza cia	Rock Bunting	24.04.2021	1	46,20616	38,99611	3
Emberiza cia	Rock Bunting	24.04.2021	1	46,20652	39,02406	3
Turdus philomelos	Song Thrush	24.04.2021	2	46,20524	39,02369	3
Cyanistes caeruleus	Eurasian Blue Tit	24.04.2021	2	46,20562	39,03052	3
Luscinia megarhynchos golzii	Common Nightingale ssp golzii	24.04.2021	1	46,20534	39,03090	3
Columba palumbus	Common Wood Pigeon	24.04.2021	2	46,20534	39,03090	3
Fringilla coelebs	Common Chaffinch	24.04.2021	2	46,20490	39,03016	3
Garrulus glandarius	Eurasian Jay	24.04.2021	1	46,20491	39,03016	3
Buteo rufinus	Long-legged Buzzard	24.04.2021	1	46,20494	39,03016	3
Emberiza cia	Rock Bunting	24.04.2021	2	46,20533	39,03056	3
Accipiter nisus	Eurasian Sparrowhawk	24.04.2021	1	46,20532	39,03485	3
Muscicapa striata	Spotted Flycatcher	24.04.2021	1	46,20533	39,03485	3
Emberiza cia	Rock Bunting	24.04.2021	1	46,20299	39,03825	3
Falco tinnunculus tinnunculus	Common Kestrel ssp tinnunculus	24.04.2021	2	46,20299	39,03825	3
Monticola solitarius	Blue Rock Thrush	24.04.2021	2	46,20299	39,03825	3
Linaria cannabina	Common Linnet	24.04.2021	5	46,20190	39,04443	3
Pernis apivorus	European Honey Buzzard	24.04.2021	23	46,20190	39,04443	3
Falco tinnunculus tinnunculus	Common Kestrel ssp tinnunculus	24.04.2021	2	46,20190	39,04443	3
Turdus merula	Common Blackbird	24.04.2021	1	46,19669	39,05296	3
Garrulus glandarius	Eurasian Jay	24.04.2021	2	46,19669	39,05296	3
Coturnix coturnix	Common Quail	24.04.2021	1	46,19669	39,05296	3
Alauda arvensis armenica	Eurasian Skylark ssp armenica	24.04.2021	1	46,19669	39,05297	3
Sitta neumayer	Western Rock Nuthatch	24.04.2021	1	46,19530	39,05838	3



Lanius collurio	Red-backed Shrike	24.04.2021	2	46,19682	39,05538	3
Turdus philomelos	Song Thrush	24.04.2021	1	46,19682	39,05538	3
Coturnix coturnix	Common Quail	24.04.2021	2	46,19685	39,05540	3
Prunella modularis obscura	Dunnock ssp obscura	24.04.2021	1	46,19685	39,05540	3
Muscicapa striata	Spotted Flycatcher	24.04.2021	1	46,19241	39,05970	3
Saxicola rubetra	Whinchat	24.04.2021	2	46,19240	39,05972	3
Curruca crassirostris	Eastern Orphean Warbler	24.04.2021	2	46,18338	39,07253	3
Emberiza cia	Rock Bunting	24.04.2021	1	46,18406	39,07211	3
Accipiter nisus	Eurasian Sparrowhawk	24.04.2021	1	46,18406	39,07211	3
Buteo rufinus	Long-legged Buzzard	24.04.2021	2	46,17607	39,08131	3
Garrulus glandarius	Eurasian Jay	24.04.2021	1	46,17495	39,08329	3
Erithacus rubecula	European Robin	24.04.2021	1	46,17495	39,08329	3
Lullula arborea	Woodlark	24.04.2021	1	46,17271	39,08477	3
Garrulus glandarius	Eurasian Jay	24.04.2021	2	46,17081	39,08764	3
Motacilla alba	White Wagtail	24.04.2021	1	46,19374	39,15082	3
Turdus merula	Common Blackbird	24.04.2021	2	46,19454	39,15155	3
Passer montanus	Eurasian Tree Sparrow	24.04.2021	4	46,19678	39,15306	3
Corvus corax	Northern Raven	24.04.2021	1	46,19679	39,15306	3
Corvus corax corax	Northern Raven ssp corax	24.04.2021	1	46,20481	39,16103	3
Garrulus glandarius	Eurasian Jay	24.04.2021	1	46,20740	39,16291	3
Motacilla alba	White Wagtail	24.04.2021	1	46,20913	39,16426	3
Emberiza cia	Rock Bunting	24.04.2021	1	46,21120	39,16459	3
Lanius minor	Lesser Grey Shrike	08.05.2021	2	46,20716	38,98981	4
Cettia cetti	Cetti's Warbler	08.05.2021	1	46,20184	39,03850	4
Motacilla alba	White Wagtail	08.05.2021	1	46,20188	39,03849	4
Emberiza cia	Rock Bunting	08.05.2021	2	46,20188	39,03849	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,20187	39,03849	4
Buteo rufinus	Long-legged Buzzard	08.05.2021	2	46,19729	39,05087	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,19731	39,05086	4
Emberiza cia	Rock Bunting	08.05.2021	2	46,19731	39,05086	4
Coturnix coturnix	Common Quail	08.05.2021	1	46,19731	39,05086	4
Buteo rufinus	Long-legged Buzzard	08.05.2021	2	46,19476	39,05640	4
Cinclus cinclus	White-throated Dipper	08.05.2021	1	46,19717	39,05701	4
Muscicapa striata	Spotted Flycatcher	08.05.2021	1	46,19717	39,05704	4
Sitta neumayer	Western Rock Nuthatch	08.05.2021	2	46,19717	39,05704	4
Perdix perdix	Grey Partridge	08.05.2021	7	46,19287	39,05925	4
Perdix perdix	Grey Partridge	08.05.2021	4	46,19284	39,05983	4



Sturnus vulgaris caucasicus	Common Starling ssp caucasicus	08.05.2021	20	46,19284	39,05983	4
Coturnix coturnix	Common Quail	08.05.2021	1	46,19283	39,05983	4
Corvus corax	Northern Raven	08.05.2021	2	46,19283	39,05983	4
Columba palumbus	Common Wood Pigeon	08.05.2021	2	46,19283	39,05983	4
Emberiza cia	Rock Bunting	08.05.2021	2	46,19283	39,05981	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,19284	39,05981	4
Parus major	Great Tit	08.05.2021	1	46,19284	39,05981	4
Emberiza cia	Rock Bunting	08.05.2021	2	46,18015	39,07723	4
Cinclus cinclus	White-throated Dipper	08.05.2021	1	46,18016	39,07720	4
Aegithalos caudatus	Long-tailed Tit	08.05.2021	7	46,17726	39,08039	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,17726	39,08039	4
Parus major	Great Tit	08.05.2021	1	46,17726	39,08039	4
Curruca communis	Common Whitethroat	08.05.2021	2	46,17726	39,08039	4
Saxicola rubetra	Whinchat	08.05.2021	1	46,17723	39,08036	4
Motacilla alba	White Wagtail	08.05.2021	2	46,17722	39,08036	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,17722	39,08036	4
Emberiza cia	Rock Bunting	08.05.2021	1	46,17722	39,08036	4
Turdus viscivorus	Mistle Thrush	08.05.2021	1	46,17082	39,08736	4
Erithacus rubecula	European Robin	08.05.2021	1	46,17082	39,08735	4
Dendrocopos major	Great Spotted Woodpecker	08.05.2021	1	46,17081	39,08735	4
Buteo rufinus	Long-legged Buzzard	08.05.2021	2	46,17086	39,08754	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,17086	39,08754	4
Turdus merula	Common Blackbird	08.05.2021	1	46,17086	39,08754	4
Turdus merula	Common Blackbird	08.05.2021	1	46,17090	39,08752	4
Turdus merula	Common Blackbird	08.05.2021	1	46,19323	39,15104	4
Accipiter nisus	Eurasian Sparrowhawk	08.05.2021	1	46,19324	39,15104	4
Motacilla alba	White Wagtail	08.05.2021	1	46,19614	39,15272	4
Merops apiaster	European Bee-eater	08.05.2021	12	46,20088	39,15622	4
Columba palumbus	Common Wood Pigeon	08.05.2021	3	46,20088	39,15622	4
Garrulus glandarius	Eurasian Jay	08.05.2021	1	46,20911	39,16414	4
Emberiza cia	Rock Bunting	08.05.2021	22	46,21164	39,16474	4
Motacilla alba	White Wagtail	08.05.2021	1	46,21164	39,16474	4
Corvus corax	Northern Raven	08.05.2021	2	46,21167	39,16476	4
Periparus ater	Coal Tit	09.05.2021	1	46,21268	38,97112	5
Columba livia	Rock Dove	09.05.2021	6	46,21268	38,97112	5
Upupa epops	Eurasian Hoopoe	09.05.2021	2	46,21269	38,97112	5
Motacilla alba	White Wagtail	09.05.2021	1	46,21269	38,97112	5



Chloris chloris	European Greenfinch	09.05.2021	1	46,21269	38,97112	5
Motacilla alba alba	White Wagtail ssp alba	09.05.2021	1	46,21268	38,97111	5
Oenanthe isabellina	Isabelline Wheatear	09.05.2021	1	46,21268	38,97112	5
Corvus corone	Carrion Crow	09.05.2021	2	46,21268	38,97112	5
Cinclus cinclus	White-throated Dipper	09.05.2021	2	46,21424	38,97639	5
Emberiza cia	Rock Bunting	09.05.2021	1	46,20726	38,98275	5
Garrulus glandarius	Eurasian Jay	09.05.2021	1	46,20738	38,98273	5
Picus viridis	European Green Woodpecker	09.05.2021	1	46,20621	38,99567	5
Garrulus glandarius	Eurasian Jay	09.05.2021	1	46,20737	38,99559	5
Currucua communis	Common Whitethroat	09.05.2021	22	46,20737	38,99559	5
Luscinia megarhynchos	Common Nightingale	09.05.2021	1	46,20703	38,99569	5
Oriolus oriolus	Eurasian Golden Oriole	09.05.2021	2	46,20684	38,99575	5
Muscicapa striata	Spotted Flycatcher	09.05.2021	1	46,20672	38,99572	5
Fringilla coelebs	Common Chaffinch	09.05.2021	2	46,20666	38,99572	5
Garrulus glandarius	Eurasian Jay	09.05.2021	1	46,20667	38,99573	5
Cyanistes caeruleus	Eurasian Blue Tit	09.05.2021	2	46,20524	39,02996	5
Saxicola maurus maurus	Siberian Stonechat ssp maurus	09.05.2021	1	46,20518	39,02992	5
Phoenicurus phoenicurus	Common Redstart	09.05.2021	2	46,20542	39,03044	5
Garrulus glandarius	Eurasian Jay	09.05.2021	1	46,20542	39,03044	5
Accipiter nisus	Eurasian Sparrowhawk	09.05.2021	1	46,18800	39,06140	5
Merops apiaster	European Bee-eater	09.05.2021	55	46,18805	39,06139	5
Corvus corax	Northern Raven	09.05.2021	2	46,18834	39,06163	5
Perdix perdix	Grey Partridge	09.05.2021	3	46,18832	39,06161	5
Garrulus glandarius	Eurasian Jay	09.05.2021	1	46,18832	39,06161	5
Turdus merula	Common Blackbird	09.05.2021	2	46,18841	39,06142	5
Fringilla coelebs	Common Chaffinch	09.05.2021	1	46,18870	39,06081	5
Coturnix coturnix	Common Quail	09.05.2021	1	46,18872	39,06074	5
Dendrocopos major	Great Spotted Woodpecker	09.05.2021	1	46,19152	39,06004	5
Turdus merula	Common Blackbird	09.05.2021	2	46,19151	39,06004	5
Muscicapa striata	Spotted Flycatcher	09.05.2021	1	46,19101	39,06015	5
Fringilla coelebs	Common Chaffinch	09.05.2021	2	46,19099	39,06017	5
Chloris chloris	European Greenfinch	09.05.2021	2	46,19046	39,06039	5
Pernis apivorus	European Honey Buzzard	09.05.2021	5	46,17990	39,07771	5
Erithacus rubecula	European Robin	09.05.2021	1	46,17990	39,07771	5
Garrulus glandarius	Eurasian Jay	09.05.2021	2	46,17988	39,07770	5
Emberiza cia	Rock Bunting	09.05.2021	1	46,17987	39,07769	5



<i>Curruca communis</i>	Common Whitethroat	09.05.2021	2	46,17460	39,14837	5
<i>Troglodytes hiemalis</i>	Winter Wren	09.05.2021	1	46,18057	39,14884	5
<i>Tichodroma muraria</i>	Wallcreeper	09.05.2021	1	46,18057	39,14884	5
<i>Pyrrhula pyrrhula</i>	Eurasian Bullfinch	09.05.2021	2	46,18057	39,14884	5
<i>Cettia cetti</i>	Cetti's Warbler	09.05.2021	1	46,18327	39,14967	5
<i>Falco tinnunculus / Falco naumanni</i>	Common Kestrel / Lesser Kestrel	09.05.2021	2	46,18327	39,14967	5
<i>Periparus ater michalowskii</i>	Coal Tit ssp michalowskii	09.05.2021	1	46,18334	39,14965	5
<i>Motacilla alba alba</i>	White Wagtail ssp alba	09.05.2021	1	46,18333	39,14965	5
<i>Emberiza cia</i>	Rock Bunting	09.05.2021	1	46,18332	39,14965	5
<i>Turdus merula</i>	Common Blackbird	09.05.2021	1	46,18216	39,14903	5
<i>Columba palumbus</i>	Common Wood Pigeon	09.05.2021	2	46,18216	39,14903	5
<i>Garrulus glandarius</i>	Eurasian Jay	09.05.2021	1	46,21034	39,16446	5
<i>Motacilla alba</i>	White Wagtail	09.05.2021	1	46,21025	39,16441	5
<i>Coracias garrulus</i>	Сизоворонка	01.07.2021	8	46,26160	38,88530	6
<i>Lanius collurio</i>	Обыкновенный жулан	01.07.2021	1	46,20860	38,97926	6
<i>Prunella modularis</i>	Лесная завирушка	01.07.2021	1	46,19477	39,05632	6
<i>Cercotrichas galactotes syriaca</i>	Тугайный соловей ssp syriaca	01.07.2021	1	46,19536	39,05640	6
<i>Turdus merula</i>	Чёрный дрозд	01.07.2021	1	46,18386	39,05588	6
<i>Corvus corax</i>	Ворон	01.07.2021	3	46,18386	39,05585	6
<i>Garrulus glandarius</i>	Сойка	01.07.2021	1	46,19439	39,05185	6
<i>Motacilla alba alba</i>	Белая трясогузка ssp alba	01.07.2021	1	46,19495	39,05173	6
<i>Merops apiaster</i>	Золотистая щурка	01.07.2021	3	46,19532	39,05164	6
<i>Buteo buteo</i>	Обыкновенный канюк	01.07.2021	1	46,19532	39,05164	6
<i>Buteo buteo vulpinus</i>	Обыкновенный канюк ssp vulpinus	01.07.2021	1	46,19530	39,05164	6
<i>Buteo rufinus</i>	Курганник	01.07.2021	1	46,19532	39,05164	6
<i>Hieraaetus pennatus</i>	Орел-карлик	01.07.2021	1	46,19532	39,05165	6
<i>Buteo rufinus</i>	Курганник	01.07.2021	1	46,20731	39,02660	6
<i>Petronia petronia</i>	Каменный воробей	01.07.2021	1	46,24514	38,89896	6
<i>Alectoris chukar</i>	Кеклик	01.07.2021	9	46,24508	38,89909	6
<i>Hippolais languida</i>	Пустынная пересмешка	01.07.2021	1	46,24537	38,89888	6
<i>Hippolais languida</i>	Пустынная пересмешка	01.07.2021	4	46,24535	38,89881	6



Emberiza melanocephala	Черноголовая овсянка	01.07.2021	3	46,22821	38,89687	6
Linaria cannabina	Коноплянка	01.07.2021	2	46,22792	38,89681	6
Oenanthe melanoleuca	Черноухая каменка	01.07.2021	3	46,22794	38,89681	6
Clanga pomarina	Малый подорлик	01.07.2021	2	46,22829	38,89685	6
Motacilla alba alba	Белая трясогузка ssp alba	02.07.2021	1	46,20707	38,85461	7
Corvus cornix	Серая ворона	02.07.2021	1	46,22296	38,86630	7
Pyrrhocorax pyrrhocorax	Клушица	02.07.2021	1	46,22405	38,86648	7
Corvus cornix	Серая ворона	02.07.2021	2	46,25636	38,88365	7
Pyrrhocorax pyrrhocorax	Клушица	02.07.2021	2	46,25821	38,88548	7
Monticola solitarius	Синий каменный дрозд	02.07.2021	1	46,30017	38,90474	7
Accipiter brevipes	Европейский тювик	02.07.2021	1	46,21786	38,93187	7
Petronia petronia	Каменный воробей	02.07.2021	1	46,21962	38,93573	7
Corvus cornix	Серая ворона	02.07.2021	1	46,21349	38,94823	7
Curruca communis	Серая славка	02.07.2021	1	46,21223	38,94994	7
Phylloscopus collybita caucasicus	Пеночка-теньковка ssp caucasicus	02.07.2021	1	46,21217	38,95001	7
Pica pica	Сорока	02.07.2021	1	46,21370	38,96340	7
Turdus merula	Чёрный дрозд	02.07.2021	1	46,21297	38,96702	7
Motacilla alba alba	Белая трясогузка ssp alba	02.07.2021	1	46,21290	38,96701	7
Garrulus glandarius	Сойка	02.07.2021	1	46,21290	38,96701	7
Accipiter brevipes	Европейский тювик	02.07.2021	1	46,21290	38,96701	7
Cyanistes caeruleus	Лазоревка	02.07.2021	1	46,21290	38,96701	7
Parus major	Большая синица	02.07.2021	1	46,21284	38,96703	7
Luscinia luscinia	Обыкновенный соловей	02.07.2021	3	46,21284	38,96703	7
Corvus cornix	Серая ворона	03.07.2021	9	46,21078	38,85561	8
Coracias garrulus	Сизоворонка	03.07.2021	1	46,21713	38,86548	8
Merops apiaster	Золотистая щурка	03.07.2021	9	46,21680	38,86565	8
Falco tinnunculus	Обыкновенная пустельга	03.07.2021	1	46,21674	38,86568	8
Falco tinnunculus	Обыкновенная пустельга	03.07.2021	1	46,21703	38,86552	8
Pica pica	Сорока	03.07.2021	1	46,22670	38,86713	8
Oenanthe finschii	Черношейная каменка	03.07.2021	1	46,22763	38,86722	8
Ptyonoprogne rupestris	Скальная ласточка	03.07.2021	1	46,23421	38,86923	8
Columba livia	Сизый голубь	03.07.2021	1	46,23479	38,86940	8
Petronia petronia	Каменный воробей	03.07.2021	1	46,23658	38,87009	8



Passer montanus	Полевой воробей	03.07.2021	4	46,24348	38,87583	8
Turdus merula	Чёрный дрозд	03.07.2021	1	46,24830	38,87797	8
Pica pica	Сорока	03.07.2021	1	46,24829	38,87796	8
Coracias garrulus	Сизоворонка	03.07.2021	1	46,24831	38,87796	8
Merops apiaster	Золотистая щурка	03.07.2021	1	46,24829	38,87793	8
Pastor roseus	Розовый скворец	03.07.2021	1	46,24844	38,87810	8
Emberiza melanocephala	Черноголовая овсянка	03.07.2021	1	46,24829	38,87799	8
Corvus corax	Ворон	03.07.2021	1	46,24830	38,87799	8
Pyrrhocorax pyrrhocorax	Клушица	03.07.2021	1	46,24829	38,87800	8
Sitta tephronota	Большой скальный поползень	03.07.2021	1	46,24829	38,87801	8
Sitta neumayer	Малый скальный поползень	03.07.2021	1	46,24829	38,87802	8
Columba palumbus	Вяхрь	03.07.2021	1	46,24863	38,87814	8
Oenanthe finschii	Черношейная каменка	03.07.2021	1	46,25089	38,87936	8
Alectoris chukar	Кеклик	03.07.2021	1	46,25091	38,87933	8
Oenanthe melanoleuca	Черноухая каменка	03.07.2021	1	46,25092	38,87932	8
Columba livia	Сизый голубь	03.07.2021	1	46,25308	38,88052	8
Ptyonoprogne rupestris	Скальная ласточка	03.07.2021	1	46,25323	38,88063	8
Dendrocopos syriacus	Сирийский дятел	03.07.2021	1	46,25781	38,88648	8
Motacilla cinerea	Горная трясогузка	03.07.2021	1	46,25791	38,88664	8
Alectoris chukar	Кеклик	03.07.2021	1	46,25780	38,88634	8
Passer montanus	Полевой воробей	03.07.2021	2	46,25805	38,89010	8
Oenanthe finschii	Черношейная каменка	03.07.2021	1	46,25932	38,88991	8
Falco peregrinus	Сапсан	03.07.2021	1	46,25776	38,89185	8
Corvus cornix	Серая ворона	03.07.2021	1	46,25599	38,89291	8
Motacilla alba alba	Белая трясогузка ssp alba	03.07.2021	1	46,25539	38,89340	8
Accipiter brevipes	Европейский тювик	03.07.2021	1	46,25519	38,89344	8
Otus scops	Сплюшка	03.07.2021	1	46,21276	38,96698	8
Emberiza cia	Горная овсянка	03.07.2021	1	46,23565	38,90520	8
Linaria cannabina	Коноплянка	03.07.2021	1	46,23556	38,90520	8
Falco peregrinus	Сапсан	03.07.2021	1	46,23556	38,90520	8
Sitta neumayer	Малый скальный поползень	03.07.2021	3	46,23556	38,90520	8
Oenanthe oenanthe	Обыкновенная каменка	03.07.2021	1	46,23557	38,90522	8
Lanius senator	Красноголовый сорокопуд	03.07.2021	1	46,23490	38,90496	8



Streptopelia turtur	Обыкновенная горлица	03.07.2021	1	46,23274	38,91139	8
Falco peregrinus	Сапсан	03.07.2021	1	46,23274	38,91135	8
Parus major	Большая синица	03.07.2021	1	46,23218	38,91340	8
Phylloscopus trochilus	Пеночка-весничка	03.07.2021	1	46,23215	38,91365	8
Monticola solitarius	Синий каменный дрозд	03.07.2021	1	46,23207	38,91431	8
Sitta tephronota	Большой скальный поползень	03.07.2021	1	46,23207	38,91431	8
Curruca communis	Серая славка	03.07.2021	1	46,23207	38,91432	8
Alectoris chukar	Кеклик	03.07.2021	1	46,23210	38,91428	8
Motacilla alba alba	Белая трясогузка ssp alba	03.07.2021	1	46,23150	38,91645	8
Troglodytes troglodytes	Крапивник	03.07.2021	1	46,22499	38,91787	8
Curruca communis	Серая славка	03.07.2021	1	46,21986	38,93465	8
Parus major	Большая синица	03.07.2021	1	46,21999	38,93502	8
Aegithalos caudatus major	Длиннохвостая синица ssp major	03.07.2021	6	46,21379	38,94514	8
Carduelis carduelis	Черноголовый щегол	03.07.2021	5	46,21104	38,95370	8
Motacilla alba alba	Белая трясогузка ssp alba	03.07.2021	1	46,21109	38,95566	8
Oriolus oriolus	Обыкновенная иволга	03.07.2021	1	46,21107	38,95572	8
Corvus cornix	Серая ворона	03.07.2021	1	46,21110	38,95594	8
Parus major	Большая синица	03.07.2021	1	46,21120	38,95663	8
Cinclus cinclus	Оляпка	03.07.2021	1	46,21129	38,95702	8
Garrulus glandarius	Сойка	03.07.2021	1	46,20674	38,99361	8
Luscinia luscinia	Обыкновенный соловей	03.07.2021	1	46,20622	38,99546	8
Columba palumbus	Вяхирь	03.07.2021	1	46,20650	38,99670	8
Corvus corax	Ворон	03.07.2021	1	46,20645	38,99670	8
Emberiza cia	Горная овсянка	03.07.2021	2	46,20684	38,99713	8
Turdus merula	Чёрный дрозд	03.07.2021	1	46,20734	39,00063	8
Garrulus glandarius	Сойка	03.07.2021	1	46,20744	39,00102	8
Turdus merula	Чёрный дрозд	03.07.2021	1	46,20669	39,02757	8
Carduelis carduelis	Черноголовый щегол	03.07.2021	1	46,20564	39,03071	8
Curruca communis	Серая славка	03.07.2021	1	46,20564	39,03071	8
Cyanistes caeruleus	Лазоревка	03.07.2021	1	46,20565	39,03061	8
Garrulus glandarius	Сойка	03.07.2021	1	46,20567	39,03059	8
Saxicola rubicola	Черноголовый чекан	03.07.2021	1	46,20568	39,03055	8
Carpodacus erythrinus	Обыкновенная чечевица	03.07.2021	1	46,20565	39,03049	8



Oriolus oriolus	Обыкновенная иволга	03.07.2021	1	46,20737	39,02433	8
Cyanistes caeruleus	Лазоревка	04.07.2021	1	46,24322	38,89746	9
Sitta neumayer	Малый скальный поползень	04.07.2021	1	46,22405	38,89610	9
Columba livia	Сизый голубь	04.07.2021	1	46,22406	38,89610	9
Saxicola rubicola	Черноголовый чекан	04.07.2021	1	46,22406	38,89610	9
Carduelis carduelis	Черноголовый щегол	04.07.2021	1	46,22406	38,89613	9
Falco tinnunculus	Обыкновенная пустельга	04.07.2021	1	46,22404	38,89611	9
Alectoris chukar	Кеклик	04.07.2021	1	46,22348	38,89595	9
Oenanthe melanoleuca	Черноухая каменка	04.07.2021	1	46,22347	38,89594	9
Oenanthe finschii	Черношейная каменка	04.07.2021	1	46,22337	38,89577	9
Gyps fulvus	Белоголовый сип	04.07.2021	3	46,22026	38,89775	9
Gyps fulvus	Белоголовый сип	04.07.2021	1	46,22026	38,89775	9
Dendrocopos syriacus	Сирийский дятел	04.07.2021	1	46,24044	38,89778	9
Garrulus glandarius	Сойка	04.07.2021	1	46,24079	38,89782	9
Accipiter brevipes	Европейский тювик	04.07.2021	1	46,24092	38,89801	9

Mammals

Based on the existing literature and datasets collected during our field visits to the study area, a list has been compiled showing (Table 29) species with the probability of occurrence or occupancy, visually detected species and actually documented signs of animal activities. Species included in the IUCN Red List of Globally Threatened Species and the Armenian Red Book of Animals are highlighted red and a relevant brief description is provided for each of them.

Table 29: List of mammals in the study area

No.	Scientific name	English name	1	2	3
Erinaceidae					
1.	<i>Erinaceus concolor</i>	Southern white-breasted hedgehog	+	+	
Bovidae					
2.	<i>Capra aegagrus</i>	Wild goat	+	+	NT vu
3.	<i>Ovis orientalis gmelinii</i>	Armenian mouflon	+	-	VU en
Soricidae					
4.	<i>Sorex araneus</i>	Common shrew	+	-	
5.	<i>Neomys teres (schelkovnikovi)</i>	Transcaucasian water shrew	+	+	LC en
Gliridae					



6.	<i>Dryomys nitedula</i>	Forest dormouse	+	+	
Hystricidae					
7.	<i>Hystrix indica</i>	Indian crested porcupine	+	+	LC vu
Leporidae					
8.	<i>Lepus europaeus</i>	European hare	+	+	
Cervidae					
9.	<i>Capreolus capreolus</i>	Roe deer	+	+	
Suidae					
10.	<i>Sus scrofa</i>	Wild boar	+	+	
Mustelidae					
11.	<i>Martes foina</i>	Beech marten	+	+	
12.	<i>Mustela nivalis</i>	Least weasel	+	+	
13.	<i>Meles meles</i>	Badger	+	+	
14.	<i>Lutra lutra</i>	Eurasian otter	+	+	NT en
Ursidae					
15.	<i>Ursus arctos</i>	Brown bear	+	+	LC vu
Canidae					
16.	<i>Canis lupus</i>	Gray wolf	+	+	
17.	<i>Canis aureus</i>	Jackal	+	+	
18.	<i>Vulpes vulpes</i>	Red fox	+	+	
Felidae					
19.	<i>Felis silvestris</i>	Wildcat	+	-	LC vu
20.	<i>Felis chaus</i>	Jungle cat	+	+	
21.	<i>Lynx lynx</i>	Lynx	+	+	
22.	<i>Panthera pardus</i>	Leopard	+	-	VU cr
Cricetidae					
23.	<i>Cricetulus migratorius</i>	Gray dwarf hamster	+	-	
24.	<i>Arvicola terrestris</i>	European water vole	+	+	
25.	<i>Microtus arvalis</i>	Common vole	+	+	
Gerbillidae					
26.	<i>Meriones persicus</i>	Persian jird	+	-	
Muridae					
27.	<i>Sylvaemus uralensis</i>	Ural field mouse	+	+	

1. Presence data according to different sources
2. Presence data according to our survey results

* Species listed in the IUCN Red List and Red Book of Animals of Armenia (highlighted red).

Reptiles and Amphibians



Observations of reptiles and amphibians were held along the entire length of the projected roadway and its environs. Some difficulty was caused by fencing of the private orchard plots from metal wire netting and dry twigs. In some cases, it was not possible to do the species identification of reptiles because of their ability to rapidly sneak away and hide behind rocks. In most cases, we had to spend a lot of time waiting for the animal to re-appear or examine the orchard by walking around the entire territory. Table 30 draws up a list of species that are referenced in the literature sources and have been actually documented in the project area.

Table 30: List of reptiles and amphibians of the study area

No. Family		Scientific name	English name	1	2	3
Reptilian						
Testudinidae	1.	<i>Testudo graeca</i>	Greek tortoise	+	+	VU vu
Gekkonidae	2.	<i>Tenuidactylus caspius</i>	Caspian bent-toed gecko	+	+	
Anguidae	3.	<i>Pseudopus apodus</i>	Sheltopusik	+	+	
Agamidae	4.	<i>Laudakia caucasia</i>	Caucasian agama	+	+	
Scincidae	5.	<i>Ablepharus bivittatus</i>	Twin-striped skink	+	-	
Scincidae	6.	<i>Trachylepis septemtaeniata</i>	East Asian Mabuya	+	+	DD vu
Scincidae	7.	<i>Eumeces schneideri</i>	Schneider's skink	+	+	LC vu
Lacertidae	8.	<i>Ophisops elegans</i>	Snake-eyed lizard	+	+	
	9.	<i>Darevskia raddei</i>	Darevskia raddei	+	+	
	10.	<i>Lacerta media</i>	Medium Lizard,	+	-	
	11.	<i>Lacerta strigata</i>	Caucasus emerald lizard	+	+	
	12.	<i>Eremias strauchi</i>	Strauch's racerunner	+	+	
Typhlopidae	13.	<i>Typhlops vermicularis</i>	European worm snake	+	+	
Boidae	14.	<i>Eryx jaculus</i>	Javelin sand boa	+	+	
Colubridae	15.	<i>Natrix natrix</i>	Grass snake	+	+	
	16.	<i>Natrix tessellata</i>	Dice snake	+	+	
	17.	<i>Hemorrhois nummifer</i>	Coin-marked snake	+	-	
	18.	<i>Platyceps najadum</i>	Dahl's whip snake	+	+	
	19.	<i>Hidrophis schmidtii</i>	Schmidt's whip snake	+	-	
	20.	<i>Elaphe sauromates</i>	Pallas snake	+	-	
	21.	<i>Zamenis hohenackeri</i>	Transcaucasian rat snake	+	+	LC vu
	22.	<i>Coronella austriaca</i>	Smooth snake	+	-	
	23.	<i>Rhynchocalamus melanocephalus</i>	Black-headed ground snake	+	+	LC vu
	24.	<i>Eirenis collaris</i>	Collared Eirenis	+	-	
	25.	<i>Eirenis punctatolineatus</i>	Dotted dwarf racer	+	-	
	26.	<i>Pseudocyclophis persicus</i>	Dark-headed dwarf racer	+	-	- cr
	27.	<i>Telescopus fallax</i>	Caucasean cat snake	+	-	LC vu
	28.	<i>Malpolon monspessulanus</i>	Montpellier snake	+	+	
Viperidae	29.	<i>Vipera (Montivipera) raddei</i>	Armenian viper	+	+	NT vu
	30.	<i>Macrovipera (Vipera) lebetina</i>	Lebetine viper	+	+	



Amphibians						
Bufonidae	31.	<i>Bufo viridis</i>	European green toad	+	+	
Hylidae	32.	<i>Hyla savigny</i>	Малоазиатская квакша	+	+	
Ranidae	33.	<i>Rana ridibunda</i>	Marsh frog	+	+	
	34.	<i>Rana macrocnemis</i>	Long-legged wood frog	+	+	

1. Presence data according to different sources
2. Presence data according to our survey results
 - * Species listed in the IUCN Red List and Red Book of Animals of Armenia and highlighted red.

Photos taken in the Kajaran-Agarak section of the North-South highway



Examining tracks



Sky scanning for birds



Catch for species ID



Photography



Griffon Vulture



Lammergeier



Long-legged Buzzard



Red-billed Chough



Levant Sparrowhawk



Chukar



Rufous-tailed Rock-thrush



Rufous-tailed Scrub-robin



European Bee-eater



European Goldfinch



Red-backed Shrike



Lesser Grey Shrike



Common Woodpigeon



Eurasian Collared-dove



Red-tailed Wheatear



Rock Bunting



Whinchat



Grey Wagtail



Blue Tit



Common Stonechat



Common Starling



Rosy Starling



Red-fronted Serin



White Wagtail



Eurasian Nightjar



Eurasian Hoopoe



Roe deer





Fox





Bear excrement	Badger excrement
	
Lutra excrement	Porcupine needles

	
Jackal	Jackal footprints



Caspian bent-toed gecko



Caucasian agama



Golden mabuya



Snake-eyed lizard



Darevskia raddei



Caucasus emerald lizard



Strauch's racerunner



European worm snake



Javelin sand boa



Grass snake



Montpellier snake



Black-headed ground snake



Transcaucasian rat snake



Long-legged wood frog



Savigny's treefrog



Greek tortoise

Summary of Red Listed species (Red book of RA)

The Red Book of Plants and Animals of the Republic of Armenia was studied with the aim of finding out the probability of encountering the animals and plants registered in the Red Book of the Republic of Armenia in the project area. During the field researches, all Red Book animals and plants species were identified, the description of which is presented below.

Flora

Birds

Levant Sparrowhawk - *Accipiter brevipes* – listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii). The species occurs along the entire length of Meghri River. Builds nests on mature stands of walnut trees. Hunts small passerines and insects mostly here in orchards.



European Roller - *Coracias garrulous* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Near Threatened NT. According to IUCN criteria categorized as Vulnerable VU B1ab(iii). Nests in burrows in banks. Feeds on large size insects which it catches in the floodplains of the rivers Meghri and Araks, occasionally switching to small berries and seeds. They were not recorded during the field studies.

White-throated Robin - *Irania gutturalis* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Data Deficient DD. The species is very rare in the study area. Nests in dry shrubs, feeds on insects which it catches on the ground and in shrubs

Red-tailed Wheatear - *Oenanthe chrysopygia* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Endangered EN B1a+2a; D. A rare species in the study area. It was observed searching for food. Most evidently it nests in rocky outcrops of small ravines next to the projected highway near the crossing point with town Agarak.

Sombre Tit - *Parus lugubris* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii); C1a(i). The bird species favors hillsides with mixed juniper trees, shrubby thickets and small rocky outcrops, just above Meghri town.

Eastern Rock-nuthatch - *Sitta tephronota* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii). Occurs amidst lofty rock formations with shrubby vegetation on the outskirts of Meghri town. Common bird in the peripheries of the town. Forages in abandoned urban structures.

Wallcreeper - *Tichodroma muraria* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Data Deficient DD. The species was observed twice searching for food, in small rocky formations in a mixed forest above the entrance of the projected big tunnel. Apparently breeds in small rocky outcrops surrounded by the forest.

Woodchat Shrike - *Lanius senator* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii). Occurs in insignificant numbers in arid areas with short shrubby vegetation around the towns of Meghri and Agarak.

Mammals

Bezoar Goat *Capra aegagrus* - Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Vulnerable VU A2cd. According to IUCN criteria categorized as Vulnerable VU B2ab(iii); C2a(i). The species was not observed directly on the territory of proposed highway. A small mixed group of young males and females was spotted through a pair of binoculars resting on dry hills opposite the intersection point with the Lichk village. Another three males were observed in sparse juniper woodlands on the left side of the Meghri river between villages Vardanidzor and Lehvaz. Animal movements across the highway is possible during the periods of seasonal migration. **During the field studies, they were not recorded on the road section.**

Armenian mouflon - *Ovis orientalis* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Vulnerable VU A2cde. According to IUCN criteria categorized as Endangered EN D. **The species was not observed during field**



surveys. According to local hunters' movements of animals from the ridges of Zangezur mountains towards Meghri mountain chain are possible in winter.

Transcaucasian water shrew - *Neomys schelkovnikovi* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Endangered EN B1a+2a. It was documented once at the confluence of the Meghri and Mulk rivers.

Indian crested porcupine *Histryx indica* According to IUCN criteria categorized as Vulnerable VU B2a. Porcupine quills were found below the village of Lehvaz. The animal has been spotted once crossing the highway near the village of Tsghuk at night.

Eurasian Otter *Lutra lutra* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Near Threatened NT. According to IUCN criteria categorized as Endangered EN D. Old droppings were found on the stones along the course of the Meghri river, on the stretches from Lehvaz village up to Meghri town and from the Meghri town on towards the confluence of the rivers Meghri and Araks.

Brown Bear *Ursus arctos* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B2ab (iii, iv). Bear tracks have been recorded on a hillside near the entrance to the second tunnel. Bear scat was found in the forest below the summer homes which the new road is going to skirt after the second tunnel. Tracks may belong to the same individual bear.

Wild cat - *Felis silvestris* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab (iii, iv). **It was not observed during our field surveys.** According to local residents, the animal is spotted occasionally in forested areas during the collection of wild herbs.

Leopard - *Panthera pardus* In the IUCN Red List of Threatened Species (ver. 3.1), the species is categorized as Near Threatened NT and the subspecies as Endangered EN C2a(i). According to IUCN criteria categorized as Critically Endangered CR C2a(i); D Rarely seen. Movements of the animal are possible from the Zangezur mountain ridge towards Meghri mountain chain. **It was not observed during our field surveys.**

Reptiles and amphibians

As is seen from Tables 29 and 30, out of 34 species with probability of occurrence on the territory of the proposed highway, 24 have been actually recorded during our field surveys. Having said that, out of 30 reptiles likely to occur in this area 20 have been visually detected and 4 amphibians out of all 4 that were thought to occur.

Of all the 8 Red Book species found along the entire planned route, it was able to register 6 of them in the area.

Greek tortoise - *Testudo graeca* Out of 8 red listed species inhabiting the territory along the entire length of the proposed highway, 6 have been recorded. Listed in the IUCN Red List of Threatened Species (ver. 2.3) as Vulnerable VU A1cd. According to IUCN criteria categorized as Vulnerable VU A2cd; B1a+2ab(iii).



East Asian mabuya - *Trachylepis septemtaeniata* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Data Deficient DD. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii).

Schneider's skink - *Eumeces schneideri* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Least Concern. According to IUCN criteria categorized as Vulnerable VU B1ab(iii)+2ab(iii).

It should be noted that all three species – Greek tortoise, Golden mabuya and Schneider's skink - were recorded in the lowest part of the active highway by the Araks river. The proposed new road lies much above this area and will turn right in the direction of Agarak. Black-headed ground snake was spotted in the abandoned ruins of the town just below the proposed road, at the point where it will bypass the Meghri in the upper right side of the town.

Transcaucasian rat snake - *Elaphe hohenackeri* According to IUCN criteria categorized as Vulnerable VU B1ab (iii). Seen on a dry slope in a deciduous open woodland with predominant oak trees, right above the exit of the big tunnel.

Armenian viper - *Vipera (Montivipera) raddei* Listed in the IUCN Red List of Threatened Species (ver. 3.1) as Near Threatened NT. According to IUCN criteria categorized as Vulnerable VU B1a+2b (ii, iii). The species was spotted several times in the proximity of the mainroad at the intersection points with Vank and Kaler villages and in the direction of Arevik village. Apparently, these areas are used by the species for passage corridor during seasonal migration.

Flora

During field works, all the plants registered in the Red Book have been studied. All the plant species herbarum gatherings growing in the region and registered in the Red Book of RA have been also studied in the plant reserve of the Institute of Botany after A. L. Takhtajyan. The majority of the species met in the region and registered in the Red Book grow far from the impact zone of the program and they will not be imposed to any adverse effects. They mainly grow on mountain slopes, in different vegetation coexistences, located far from the present old road. They do not grow in the areas where the new road will be passing.

The species located in the impact zone, as well as data on their distribution, are shown in Table 32.

Table 31: Plant species spotted in the area of Kajaran-Agarak of the North-South highway route, registered in the RA Red Book of Plants

N	Plant species names in Armenian and Latin	Cate-gory	Distribution, habitat biotope, elevation zone, months of plant pollination and fertilization
1	5. Սոխ ակակա, <i>Allium akaka</i> S.G. Gmel	CR B1	Surroundings of Agarak, grows on 600-900 m.a.s.l. height on rocky locations, stonefalls, Phrygana 04-05, 05
2	14. Նեկտարասկորդում եռատսնաչափ, <i>Nectaroscordum tripedale</i> Grossh.	EN* B 1	Village of Aygedzor, grows on 1700- 2500 m.a.s.l. height, in forest glades, scrubs, and shrubs



3	36. Մարգացնծու սակավաճառազայթ, <i>Peucedanum pauciradiatum</i> Tamamsch	CR B 1	Surroundings of the villages of Agarak and Aldara, 800-900 m.a.s.l., dry, rocky slopes, 05, 06-07
4	50. Վարդատերեփուկ հյլինի, <i>Amberboa iljiniana</i> Grossh.	EN B 1	Surroundings of Agarak, 700-1000 m.a.s.l., Red clay, cobblestones, rocky slopes, ephemeral <i>Echinodorus</i> semi-desert, 04-05, 05-06
5	53. Վարդատերեփուկ թուրանական, <i>Amberboa turanica</i> Iljin	EN B 1	Surroundings of Agarak, 700-800 m.a.s.l., dry, rocky slopes, semi-desert, 04-05, 05-06
6	Վաղենակ պարսկական, <i>Calendula persica</i> C.A. Mey	EN B 1	Araks valley, Shvanidzor, Nrnadzor - 500-700 m.a.s.l., rocky semi-deserts, 04, 05
7	55. Տերեփուկ Ալեքսանդրի, <i>Centaurea alexandrii</i> Bordz.	EN B 1	Meghri, Araks valley, 400-1000 m.a.s.l., dry, rocky slopes, dry river-beds, river bank sand, sparse forests, Phrygana, 06, 07
8	62. Տերեփուկ Շելկովնիկովի, <i>Centaurea schelkovnikovii</i> Sosn	CR B 1	Vardanidzor, Lichk, Tashtun mountain pass, 2200-2700 m.a.s.l., rocky, breakstones, 06, 08
9	69. Խոզանափուշ երևանյան, <i>Cousinia erevanensis</i> Bornm.	EN B 1	Agarak, Meghri, Karchevan - 800-1400 m.a.s.l., rocky, stony slopes, shrubs, Phrygana, 06-07, 07-08
10	72. Խոզանափուշ մեղրիի, <i>Cousinia megrica</i> Takht.	EN B 1	Vardanidzor, Lehvaz, 700-8000 m.a.s.l., shiblak, sparse forest, dry slopes, 06-07, 07-08
11	73. Խոզանափուշ դարադաղի, <i>Cousinia qaradaghensis</i> Rech	CR B 1	Lichk, Kuris, 1100-1400, rocky, stony slopes, 06-07, 07-08
12	75. Կերեփան միջանկյալ, <i>Crupnia intermedia</i> Walp	VU* B 1	Lehvaz, Aygedzor, 1000-1700, dry rocky slopes, Juniperus and Quercus sparse forests, breakstone falls, 06, 07
13	77. Ոզնագլխիկ բազմատուն, <i>Echinops polygamous</i> Bunge	EN B 1	Shvanidzor, Kuris, Karchevan, Lehvaz, 800-1100 m.a.s.l., dry, rocky breakstone slopes, rocks, Phrygana, landfills, 06-07, 08
14	85. Յուրինեա նրբագեղ, <i>Jurinea elegans</i> (Stev.) DC.	EN B 1	Agarak, Shvanidzor, 500-1000 m.a.s.l., dry, stony slopes, rocky locations, Phrygana, 05-06, 06-07
15	104. Անմոռուկ ցեղակից, <i>Myosotis propinqua</i> Fisch. et Mey. ex DC.	EN B 1	Meghri (Goghtn) spurs, 1100-1800 m.a.s.l., forests, 05-06, 06-07:
16	119. Չազխտ կարմրակապույտ, <i>Erysimum lilacinum</i> E. Steinb.	EN B 1	Agarak, Aygedzor, Lichk, 1300-1600 m.a.s.l., forest edges, sparse forests, shrubs, 05-06, 06-07



17	120. Չագխստ խոշորասպի, <i>Erysimum macrostygma</i> Boiss. (= <i>Erysimum wagifii</i> Kassumov)	EN B 1	Meghri mountains, Karchevan, 1250-2000 m.a.s.l., dry slopes, rocky locations, rock cracks, 05-06, 07
18	129. Վահանակերպ Գրոսսեյմի, <i>Peltariopsis grossheimii</i> N. Busch	CR B 1	Surroundings of Agarak, 500-900 m.a.s.l., perpendicular slopes, rocks, 04-05, 05
19	136. Սոնալրջուն լրջունատերև, <i>Samerararia glastifolia</i> Boiss	CR B 1	Agarak, Meghri, 400-900 m.a.s.l., dry, clayey, saline soil, Phrygana, 04, 05
20	139. Չուվանդա Մեյերի, <i>Zuvanda meyeri</i> , Askerova	EN B 1	Meghri, Agarak, Araks valley, 800-1500 m.a.s.l., breakstone rocks, stony slopes, 04-05, 05
21	146. Չանգակ Չանգեզուրի, <i>Campanula zangezura</i> Kolak	EN B 1	Meghri mountains, 1600-1900 m.a.s.l., rocky locations, forest edges, 07-08, 08-09:
22	158. Մինուարցիա կոչտածաղիկ, <i>Minuartia sclerantha</i> Thell.	EN B 1	Karchevan, Nrnadzor, 550-900 m.a.s.l., sand, dry slopes, desert, semi-desert, Phrygana, 04-05, 05-06:
23	167. Անտոխլամիս կաթնախոտային, <i>Anthochlamys polygaloides</i> (Fisch. et C. A. Mey.) Fenzl		Megri, Araks valley, 600-700 m.a.s.l., sandstone soil, 06-08, 08-10:
24	190. Թանթանիկ բառաչափ, <i>Sedum tetramerum</i> Trautv.	VU* B I	Meghri river banks and river-beds, 700-1100 m.a.s.l., semi-desert rocky soil, 06, 07-08
25	191. Չմերուկ վայրի, <i>Citrullus colocynthis</i> Schrad.	CR B 1	Between the town of Meghri and the Araks river, 600-700 m.a.s.l., temporarily moisturizing sandstone soil, 08-09, 09-10.
26	205. Անմեռուկ կլորատերև, <i>Andrachne rotundifolia</i> C. A. Mey.	EN B 1	Meghri, Araks valley, 800-1000 m.a.s.l., dry, rocky soil, Phrygana, 05, 06.
27	208. Արգիրոլոբիում հացհամեմավոր, <i>Argylobium trigonelloides</i> Jaub.et Spach.	EN B 1	Meghri, Agarak, Araks valley, 500-900 m.a.s.l., dry, rocky slopes, Phrygana, 04-06, 05-06.
28	232. Գագ օրդուբադի, <i>Astragalus ordubadensis</i> Grossh	CR B 1	Agarak, Karchevan, 600-1000 m.a.s.l., dry, rocky, breakstone, clayey soil, 04-05, 05-06.
29	245. Պայթակենի Կոմարովի, <i>Colutea komarovii</i> Takht.	CR B 1	Meghri-Karchevan, 700-1000 m.a.s.l., Phrygana, dry, rocky slopes, 04, 05-06.



30	247. Մատուտակ խոզանավոր, <i>Glycyrrhiza echinata</i> L.	VU* B I	Lehvaz, 800-900 m.a.s.l., on stream and river banks, 05-06, 06-08.
31	264. Երեթևուկ խոշորածաղիկ, <i>Trifolium grandiflorum</i> Schreb.	VU* B I	Agarak, Karchevan, Levhaz, Kuris, 800-1100 m.a.s.l., dry, stony, rocky, between shrubs and scrums, Phrygana, 05-06, 06.
32	284. Մկնաստիս Միսչենկոյի, <i>Scilla mischtschenkoanna</i> Grossh.	EN B 1	Karchevan, Levhaz, 100-1700 m.a.s.l., rocy cracks, stone covers, Phrygana, 03-04, 04.
33	291.Թրաշուշան Շովիցի, <i>Gladiolus szovitsii</i> Grossh.	EN B 1	Meghri, 400-1100 m.a.s.l., rocky, clayey slopes, Artemisia (mugworts) semi-desert, shiblak, Quercus and Juniperus sparse forest, 05-06, 06-07
34	294. Հիրիկ Գրոսհեյմի, <i>Iris grossheimii</i> Woromow ex Grossh.	EN B 1	Meghri mountain chain, 1200-2400 m.a.s.l., Quercus and Juniperus sparse forests, dry, rocky slopes, steppes, 04-06, 06-07
35	299. Հիրիկ կեղծ կովկասյան, <i>Iris pseudocaucasica</i> Grossh.	EN B 1	Aygedzor, Vardanidzor, Shvanidzor, 600-1600 m.a.s.l., dry, rocky, clayey slopes, shiblak, Juniperus sparse forest, 03-05, 05-06
36	316. Վարդակակաչ Ֆլորենսկու, <i>Tulipa florenskyi</i> Woronow	EN B 1	Agarak, Karchevan Shvanidzor, 550-1000 m.a.s.l., dry, rocky slopes, clayey soil, shiblak, arid sparse forest, 04-05, 05-06
37	317. Վարդակակաչ Սոսնովսկու, <i>Tulipa sosnoskyi</i> Achverdov	EN B 1	Vardanidzor, Lichk, 700-2300 m.a.s.l., rocky location, stonefalls, landfalls, breakstones, Quercus and Juniperus sparse forest, forest edges, and glades, 04-05, 05-06
38	330. Չորապտեր արծվապտերային, <i>Cheilanthes pteridioides</i> , C.Chr.	VU* B I	From Agarak to Vardanidzor, Lichk, Araks valley, 500-1800 m.a.s.l., rock cracks and stones
39	343. Եղբորոսին բրդական, <i>Cephalanthera kurdica</i> Bornm.	VU* B I	Lehvaz, Vahavor, 1100-1700 m.a.s.l., forests, limestone slopes, 05-06, 06-07
40	348. Խոլորձ կետավոր, <i>Orchis punctulata</i> Steven	VU* B I	Vahavor, 1000-2000 m.a.s.l., sparse forests, shrubs, scrubs, forest humid glades, 04-06, 06-07
41	357. Ոզնաթուփ Ֆեդորովի, <i>Acantholimon fedorovi</i> Tamamsch.	CR B 1	Surroundings of Agarak, 700-800 m.a.s.l., rocky, limestone slopes, between the rocks, 06, 07
42	361. Գևկոր Նրբագեղ, <i>Aira elegantissima</i> Schur	EN * B I	Surroundings of Agarak, 400-1000 m.a.s.l., sandy, rocky slopes, shiblak and sparse forest, 04-05, 05-06



43	366. Ինևաքիստ պարսկական, <i>Enneapogon persicus</i> Boiss.	VU* B I	Agarak, Araks valley, 490-900 m.a.s.l., dry, rocky slopes, between the rocks, shiblak, Phrygana, 06, 07
44	367. Գեղմախոտ ռավենյան, <i>Erianthus ravennae</i> P. Beauv	VU* B I	Meghri river-bed, Araks valley, 600-800 m.a.s.l., along the sandy banks of the rivers, 05, 06
45	370. Մերկապոչուկ թեթահասկ, <i>Psilurus incurvus</i> (Gouan) Schinz et Thell.	VU* B 1	Agarak, Meghri, Nrnadzor, 400-700 m.a.s.l., rocky or fine soil slopes, river boulders, dry river-beds, stonefalls, 03-04, 04-05
46	373. Կարծրախոտ Վորոնովի, <i>Sclerochloa woronowii</i> Tzvelev	EN B 1	Agarak, 800-1700 m.a.s.l., dry, rocky, clayey, saline soil, chiseled boulders, riverside soil, 04, 05
47	396. Հափուկ գնդապտուղ, <i>Reseda globulosa</i> Fisch.	CR B 1	Agarak, 800-1000 m.a.s.l., dry, rocky slope, Phrygana, 05-06, 06-07
48	397. Լշենի նաիրյան, <i>Amygdalus nairica</i> Fed.	EN B 1	Rocks of the Araks gorge, 600-1800 m.a.s.l., dry, rocky slopes, stonefalls, rocky locations, Phrygana, dry sparse forests, 04-05, 06-09
49	414. Տանձենի Ռադդեյի, <i>Pyrus raddeana</i> Woronow	EN B 1	Lehvaz, Lichk, 1500-1800 m.a.s.l., broad-leaved forest edges, near villages, 04-05, 06-09
50	425. Ժրեբրցիա Շովիցի, <i>Jaubertia szovisii</i> Takht.	VU* B I	Surroundings of the town of Meghri, 600-1300 m.a.s.l., dry, rocky, limestone slopes, Phrygana, 06-07, 07-08
51	437. Խոնդատ երևանյան, <i>Verbascum erivanicum</i> Wulf.	CR B 1	Surroundings of Agarak, 600-1000 m.a.s.l., dry, rocky slopes, Phrygana, 05-06, 06-07
52	433. Խոնդատ բամբակալիս, <i>Verbascum gossypium</i> M. Bieb	EN * B I	Vardanidzor, 1300-1500 m.a.s.l., stony slopes, rocky locations, forest edges, 04-05, 06-07
53	440. Խոնդատ Մեղրու, <i>Verbascum megricum</i> Hub. - Mor.	EN B 1	Meghri, Shvanidzor, Nrnadzor, 600-1700 m.a.s.l., Pistacia vera, Quercus and Juniperus sparse forests, shiblak, sandy semi-desert, dry, rocky slopes, 05-06, 06-07
54	444. Հազազ անատոլիական, <i>Lycium anatolicum</i> A. Baytop	EN B 1	Agarak, Vahavor, 800-1400 m.a.s.l., dry, rocky slopes, along the the roads, Phrygana, 06-07, 07-08

Nevertheless, some species are in the impact zone or within the neighboring surroundings, and will be imposed to adverse effects. The field studies asserted the presence of certain species in the requested area. Certain plant species are also kept in the plant reserve in the habitats of which there are orchards today, their habitats have been intruded and we have not been able to find those plant species. The good thing is, though, that other



populations of those plant species registered in the Red Book have been preserved well in Arevik National Park, in locations far from the impact zone, as well as other floristic regions.

Table 32: Species of plants identified in the area that are registered in the Red Book of Plants

N	Plant name	General distribution	Can also be found outside the impact zone, in the area of	Impact zone location where it can be found
1	Populus euphratica Oliv., NT B1	Transcaucasia, Western, Anterior and Middle Asia, Afghanistan, India, Yerevan floristic region (Urtsi mountain chain)	Meghri, Karchevan, Shvanidzor, Nrnadzor, Araks river bank	On the right side of Meghri-Agarak road, low-growing individuals
2	Astragalus prilikoanus Grossh., En B 1	Nakhijevan, Eastern Transcaucasia, Talish, Northern Iran	In Armenia, it can be found in the floristic region of Zangezur (Hajat gorge, between Kapan and Kajaran, surroundings of the village of Katnarat).	Can be found in the surroundings of the community of Lernadzor, on the sloping rocky hillsides on the right side of the road, on the right-side rocky area of the road.
3	Erianthus ravennae P.Beauv., VU* B I	Ciscaucasia, Transcaucasia, Southern Europe, Mediterranean basin, Northern Africa, Middle Asia, Northern India	From Meghri to Ordubad, on the Araks river bank	On the banks of the rivers of Meghri and Araks
4	Trifolium grandiflorum Schreb., VU B1	Talish, Southerneastern Europe, Southwestern Asia, Turkey, Iran, Iraq	Karchevan, Kuris, Agarak, Lehvaz, Nrnadzor	Neighborhood of Agarak
5	Enneapogon persicus Boiss., VU B1	Caucasia, Iran, Iraq, Spain, Afghanistan, Middle Asia	In the communities of Karevan, Meghri, Agarak, Alvank, Shvanidzor, Newvadi	Grows in the neighborhood of dump № 6
6	Cousinia erivanensis Bornm., EN B1	Endem of Southern Transcaucasia, Nakhijevan, Artsakh, Armenia	Gudemnis, Agarak, Lehvaz, Vahravar, Meghri, Karchevan, Kuris	Grows in the neighborhood of dump № 5, in the area of the deserted orchard
7	Cousinia meghrica Takht., EN B1	Nakhijevan, Armenia	Vardanidzor, Lehvaz, Meghri	Grows in the area planned for the road taking from Lehvaz to Meghri's Pokr Tagh
8	Quercus araxina (Trautv.) Grossh., NT B1	Southern Transcaucasia – Nakhijevan, Artsakh,	Karchevan, Nrnadzor	In the sparse forests of the Meghri and Gozgoz river gorges



		Northern Iran, Goris, Kapan, Tsav		
9	<i>Tamarix florida</i> Bunge, EN B 1	Eastern and Southern Transcaucasia, Middle and Central Asia, Iran	On the Araks river bank, at the road section of Shvanidzor-Nrnadzor	Can be found on the left bank of river Araks, beyond the barbed wires – on the left road section of Meghri-Agarak
10	<i>Scilla mischtschenkoanna</i> Grossh., EN B 1	Nakhijevan, Northern Iran	Karchevan, Lehvaz, Nrnadzor, Aygedzor, Vardaidzor	Can be found in the cracks of the left-side rock on the crossroad from Lehvaz to Vahravar.
11	<i>Jurinea elegans</i> (Stev.) DC., EN B 1	Eastern and Southern Transcaucasia, Iran	Agarak, Karchevan, Alvank	Four km away from Agarak customs house towards Meghri, dry slopes, 580 m.
12	<i>Amygdalus nairica</i> Fed, EN B 1	Nakhijevan, Armenia	Floristic region of Meghri (in the gorges of the Araks and Meghri rivers), Vardanidzor, upper dry slopes of Agarak	On the dry rocky slopes of the Meghri river gorge
13	<i>Platanus orientalis</i> L., EN B 1 ab	On the Balkan Peninsula, countries of the Mediterranean basin, Anterior and Middle Asia, Iran, Afghanistan. Floristic region of Zangezur, in the alluviums of Tsav river and the neighboring forests.	Normally individual trees can be found in the forests of the floristic areas of Zangezur	One individual set grows near the second tunnel exit, a few planted individuals on the bank of the Meghri river
14	<i>Tulipa sosnovskyi</i> Achv. et Mirzoeva, EN B1	Nakhijevan – mountain peak of Soyukh, Armenia	Can be found in the floristic region of Zangezur – Kajaran, Lernadzor, Pkhrut, Tatev, Shikahogh, Kapan, and in the	Agarak story, near the road of Vardanidzor, dry, rocky slopes of Meghri



			floristic region of Meghri – Artsvaberd, Gyumarants, Vardanidzor, Lichk, neighboring areas of the community of Vahravar	
15	Tulipa florenskyi Woronow, EN B 1	Armenia, Nakhijevan, Southernwestern Azerbaijan, Western Iran	Agarak, Meghri, Karchevan, Shvanidzor, Nrnadzor	On the left side of the road from Lehvaz to Meghri, dry, rocky slopes of Meghri
16	Pyrus complexa Rubtzov, EN B 1	Geghami (Milli river gorge) and Dareghegis (Khachik, Yeghegis river gorges). Endemic of Armenia	Gudemnis, Vank, Jindara, Mulk, Vahravar	Forest glade situated near the road from Gozgoz river gorge
17	Pyrus raddeana Woronow, EN B 1	Nakhijevan, Southern Artsakh, Armenia. Endemic of Southern Transcaucasia	Vahravar, Tashtun, Lichqvaz, Lichk	A few meters down from the exit of the first tunnel, on the right side of the road – in the area of Arevik National Park.

This data will allow the constructors and the staff to recognize the species of plants and animals registered in the Red Bok, and take measures for their conservation.

Since the route of the new road currently under construction passes mostly through the present road and only road widening works are planned to be carried out for the work implementation, vegetation coexistences of that area will be less affected.



Հաշվետվությունը պատրաստվել է հետեվյալ մասնագետների կողմից՝		
Անուն ազգանուն	Մասնագիտություն	Ստորագրություն
Միքայել Թևոսյան	Շրջակա միջավայրի վրա ազդեցության գնահատման մասնագետ	
Մերինե Սարգսյան	Կենսաբազմազանության մասնագետ	
Հրաչիկ Միրզոյան	Կենսաբազմազանության մասնագետ	

**ANNEX 7: RECOMMENDATIONS FOR BIODIVERSITY PROTECTION**

The following measures are proposed for the protection and mitigation of adverse effects on the plants registered in the Red Book of plants growing in the construction work (including dumps) impact zones and/or in their immediate neighborhood (Table 33):

Table 33: Mitigation measures for the adverse effect of the Project on plant species

N	Plant Name	Mitigation measures
1	Populus euphratica Oliv., NT B1	With the intensive use of the territory, the growing areas are going through transformations. A total of only 5-6 individuals have been identified immediately in the impact zone of the road. Young individuals can be replanted outside the impact zone, under appropriate conditions. The plants growing outside the barbed wires, will not be damaged.
2	Astragalus prilikoanus Grossh., En B 1	Not identified immediately in the impact zone of the road; only in the mountainous areas near Lernadzor. In order to avoid harming the plant it is necessary to install a warning sign for the road builders.
3	Erianthus ravennae P.Beauv, VU* B I	The population has been significantly harmed/damaged due to building a private cafe in the area of the pond located on the left side from the intersection of Meghri-Agarak. Certain amount was recorded outside the orchard fence. In this section the new road does not reach the intersection and approaches the military unit by passing through the area of orchards. It is necessary to be careful not to damage the plants left not too far away during the road construction.
4	Trifolium grandiflorum Schreb., VU B1	Collect seeds in order to plant them after the road construction for the purpose of restoring the population.
5	Enneapogon persicus Boiss., VU B1	Install a sign closer to the habitat so that the dump trucks do not park in that location and do not smash them with tires.
6	Cousinia erivanensis Bornm., EN B1	Install a warning billboard next to the fifth dump closer to the deserted orchard.
7	Cousinia meghrica Takht., EN B1	Collect seeds for the purpose of restoring the population after the road construction. The plants can be removed with the soil out of the impact zone, not far from their natural habitat.
8	Quercus araxina Trautv. Grossh., NT B1	May be damaged during sparse forest logging. Collect the seeds for the purpose of planting them after the road construction.
9	Tamarix florida Bunge, EN B 1	Not identified on the edge of the Meghri-Agarak road. The individuals located on Araks river bank, in the surroundings of Agarak, will not be impacted, since they are located outside the bordering barbed wires.
10	Scilla mischtschenkoanna Grossh., (EN B 1)	A part of the population is in the territory of Arevik National Park. In order to preserve the population growing on the rocks of the crossroads of Lehvas-Vahravar, it is suggested to hang a warning sign in order not to damage that part of the rock during construction works.
11	Jurinea elegans (Stev.) DC., EN B 1	It is necessary to collect seeds in order to restore the plant species after the road construction in the surroundings of Agarak.



12	<i>Amygdalus nairica</i> Fed., EN B 1	A part of the population is preserved in the territory of Arevik National Park. It is quite well-spread in the region. The young individuals can be moved out from the impact zone to an appropriate habitat.
13	<i>Platanus orientalis</i> L., EN B 1	The plant is preserved in Maple Grove State (Sosu Purak) Reserve and in the territory of Shikahogh State Reserve. Individuals can be found in the floristic region of Meghri which are planted: near the second tunnel and on the bank of river Meghri. A bridge is going to be built in this section for the river crossing. It will be built high on columns and will not damage the trees. There are a few individuals, of which three are young and can be moved, the rest will partially be impacted, and some will be cut.
14	<i>Tulipa sosnovskii</i> , EN B 1	One population is preserved in the territory of Shikahogh State Reserve, and some also in the territory of Arevik National Park. Since the plant grows on 1500-2000 m.a.s.l., and the road is going to pass along the lower sections of the plant populations, the plant will not be posed to any impact. The previous locations of the population gatherings are now occupied with private orchards, and the plant was not identified in those areas.
15	<i>Tulipa florenskyi</i> Woronow, EN B 1	One population of the plant is preserved in the territory of Arevik National Park. The plant has significantly suffered, especially due to building new orchards on the road edges in the neighborhoods of the communities of Lehvaz and Meghri. The plant was not identified as a result of the investigation. In the case of identifying it during the construction it is suggested to move the plants out to the territory of Arevik National Park.
16	<i>Pyrus complexa</i> Rubtzov, EN B 1	It is probable that the plant does not get damaged, otherwise, it is advisable to take seeds from trees in autumn, pass them to any plantation operating in the area so they can grow rootstocks for planting them after the construction in the area in order to preserve the species. If possible, those trees can be moved a little afar from the impact zone in late autumn, after defoliation.
17	<i>Pyrus raddeana</i> Woronow, EN B 1	The species is preserved in Shikahogh State Reserve. It is advisable to take seeds from trees in autumn, pass them to any plantation operating in the area so they can grow rootstocks for planting them after the construction in the area in order to preserve the species.

Additionally, the measures envisaged for replanting the species registered in the Red Book of Plants are presented below:

***Trifolium grandiflorum* Schreb., VU B1**



It is an annual plant. It blooms during the months of May-June, and bears fruit in June.

The seeds are collected, dried in a cool place for a week and are kept in boxes until they are ready to be planted. The planting is done in spring.

Three individuals have been identified in the section of Agarak. The seeds can be collected also from other individuals of this plant species common for the region (Lehvaz, Kuris, Nrnadzor, Agarak, Karchevan), taking into consideration the peculiarities of seed breeding with annual plant seeds.

Cousinia meghrica Takht., EN B1

It is a subshrub. It blooms during the months of June-July and bears fruit in July-August.

Collect seeds for the purpose of planting them after the road construction in spring. The plants can also be moved with soil outside the impact zone, not too far from their habitat.

Three individuals can be met in the impact zone.

Jurinea elegans (Stev.) DC., EN B 1

It is an annual plant. It blooms during the months of May-June and bears fruit in June-July. The seeds are planted in spring.

It is necessary to collect the seeds, keep them in boxes for the purpose of planting them in the surroundings of Agarak after the road construction works are completed.

Two individuals have been identified in the impact zone. Since the plant is perennial, the seeds can be collected from the individuals growing both in this area and in the area from the border of Nakhijevan to Shvanidzor.

Platanus orientalis L., EN B 1

Five individuals of *Platanus orientalis* can be found in the impact zone, of which four will be cut. Since several plantations operate in the province of Syunik where *Platanus orientalis* is being grown, *Platanus* rootstocks need to be taken from the plantations after the road construction completion with 1:10 ratio (40 rootstocks).

Pyrus complexa Rubtzov, EN B 1

Collect the seeds in October, pass them to any plantation operating in the area so that rootstocks are grown. Do the sowing at the end of October. Usually, the germinating capacity of *Pyrus pyraeaster* seeds is 70-80%. After the road construction works are completed, replant the three-year-old rootstocks in their main habitat.

One tree can be found in the impact zone which will be cut. Pass 100 seeds to the plantation. Since the construction works are planned to be completed not earlier than in three years, and the grafting of three-year-old *Pyrus pyraeaster* is 30-40% we will have 20 viable individuals of the tree species.



Տանձենի Ռադեի Pyrus raddeana Woronow, EN B 1

Collect the seeds in October, pass them to any plantation operating in the area, so rootstocks can be grown. Do the sowing at the end of October. Usually, the germinating capacity of Pyrus pyraaster seeds is 70-80%. After the completion of the road construction works, replant the three-year-old rootstocks in the main habitat.

One tree can be identified in the impact zone which will be cut. Pass 100 seeds to the plantation. Since the road construction works will be completed no earlier than in three years, and the three-year-old rootstocks of Pyrus trees' grafting is 30-40%, so we will have 20 viable individuals of the tree.



ANNEX 8: CALCULATION OF TREE AND VEGETATION AND FOREST RESTORATION DESCRIPTION

Calculation of trees and shrub vegetation of Lernadzor-Kajaran section

Table 34: Number of trees affected in the Lernadzor section of the Kajaran-Vardanidzor tranche of the North-South highway (from the beginning of the project to the entrance of the tunnel) and shrub areas

n/n	From conditional base point to base point	Q1 - Q2	Q2 - Q3	Q3 - Q4	Q4 – P5	Q5 – Q6	Q6 – Q7 /populuses/	Q7 /Entrance of tunnel/	Total	
1	Conditional base point coordinates	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"	39° 09'55" 46° 12'45"		
2	Distance of conditional base points from each other, m	0	173	198	472	278	2053	300	3474	
3	Type of trees to be cut	Nest diameter, d, cm								
4	Walnut tree	3<d<5	18	16	9	9	-	-	-	52
5		6<d<10	9	6	3	17	-	-	-	35
6		11<d<15	-	1		3	-	-	-	4
7		16<d<20	-	-	1	-	-	-	-	1
8		21<d<25	-	-	-	-	-	-	-	
9		26< d< more	-	-	-	1	-	-	-	1
10	Trees to be cut (total)		27	23	13	30	-	-	-	93
11	Checker tree	3<d<5	1	-	-	-	-	-	-	1
12		6<d<10	-	1	-	-	-	-	-	1
13		11<d<15	-	-	-	-	-	-	-	
14		16<d<20	1	-	-	2	-	1	-	4
15		21<d<25	-	-	-	-	-	-	-	
16	26< d< more	-	-	-	1	-	-	-		
17	Trees to be cut (total)		2	1	-	3	-	1	-	6
18	Prunus	3<d<5	-	-	-	-	-	-	-	
19		6<d<10	1	-	-	2	-	-	-	3
20		11<d<15	1	-	-	-	-	10	-	11
21		16<d<20	-	1	-	-	-	-	-	1
22		21<d<25	-	-	-	1	-	-	-	1



23		26< d< more	-	-	-	3	-	-	-	3
24	Trees to be cut (total)		2	1	-	6	-	10	-	19
25	Pyrus	3<d<5	-	-	-	-	-	-	-	
26		6<d<10	-	-	-	-	-	-	-	
27		11<d<15	-	-	-	-	-	5	-	
28		16<d<20	-	-	-	-	-	-	-	
29		21<d<25	-	-	-	-	-	-	-	
30		26< d< more	-	-	-	-	-	-	-	
31	Trees to be cut (total)		-	-	-	-	-	5	-	5
32	Acer	3<d<5	-	-	-	1	-	-	-	1
33		6<d<10	-	-	-	1	-	-	-	1
34		11<d<15	-	-	-	1	-	15	-	16
35		16<d<20	-	-	-	1	-	-	-	1
36		21<d<25	-	-	-	-	-	-	-	
37		26< d< more	1	-	-	-	-	-	-	-
38	Trees to be cut (total)		1	-	-	4	-	15	-	20
39	Willow	3<d<5	-	-	-	-	-	-	-	
40		6<d<10	-	-	-	-	-	-	-	
41		11<d<15	-	-	-	-	-	-	-	
42		16<d<20	-	-	-	-	-	-	-	
43		21<d<25	-	-	-	-	-	-	-	
44		26< d< more	-	-	-	-	-	10	-	10
45	Trees to be cut (total)		-	-	-	-	-	10	-	10
46	Goat willow	11<d<15	-	-	-	-	-	-	-	
47		16<d<20	-	-	-	-	-	-	-	
48		21<d<25	-	-	-	-	-	10	-	10
49		26< d< more	-	-	-	-	-	-	-	
50	Trees to be cut (total)		-	-	-	-	-	10	-	10
51	Other trees									31
52	Disturbed lands	300							950	1250 m ²
53	Shrubs		40	70	60	100		150		420 m ²
54	Total number of the trees to be cut									194 piece

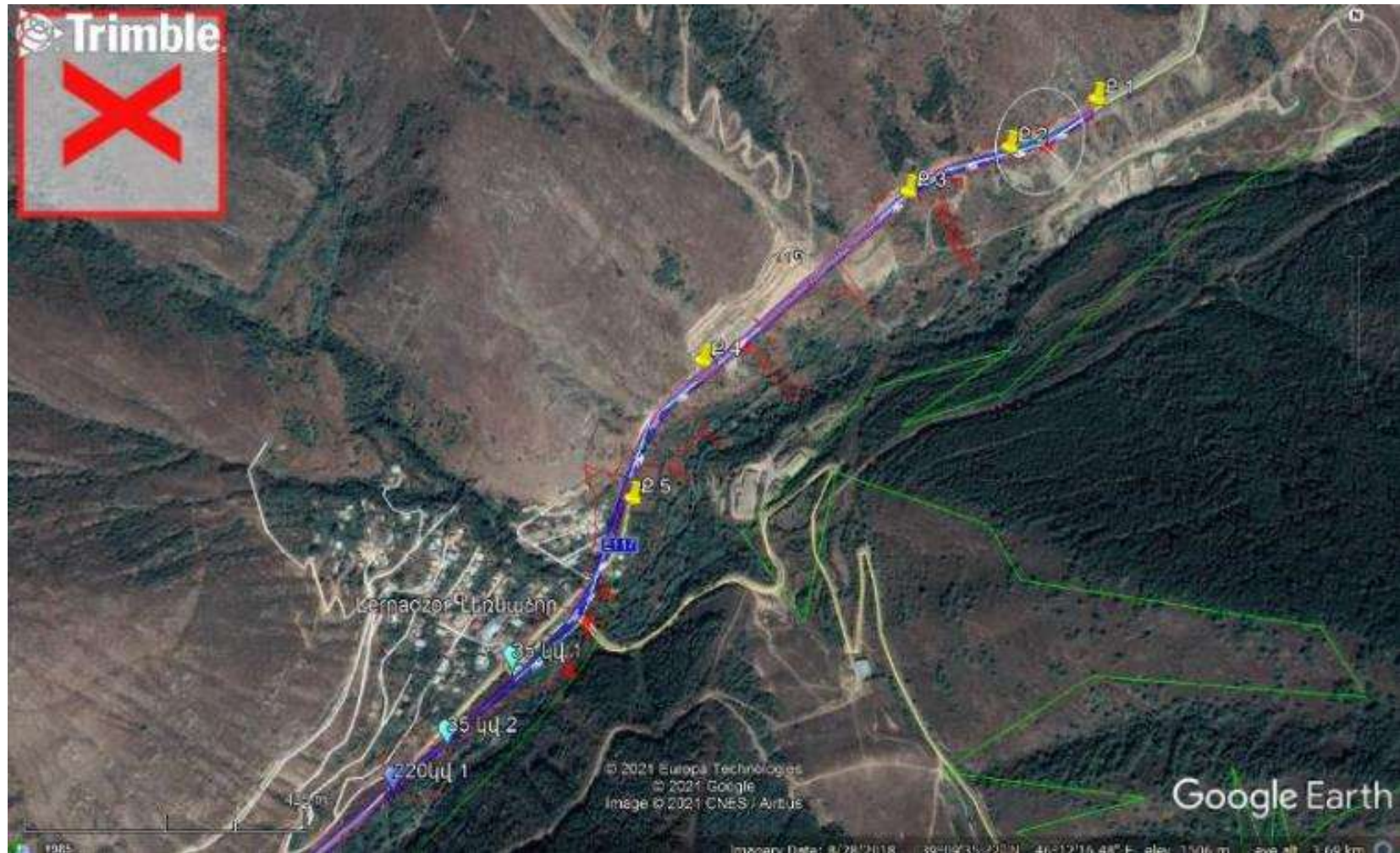


Figure 61: Google Earth program photo of the Lernadzor part of Kajaran - Vardanidzor section of North-South Highway, part-I

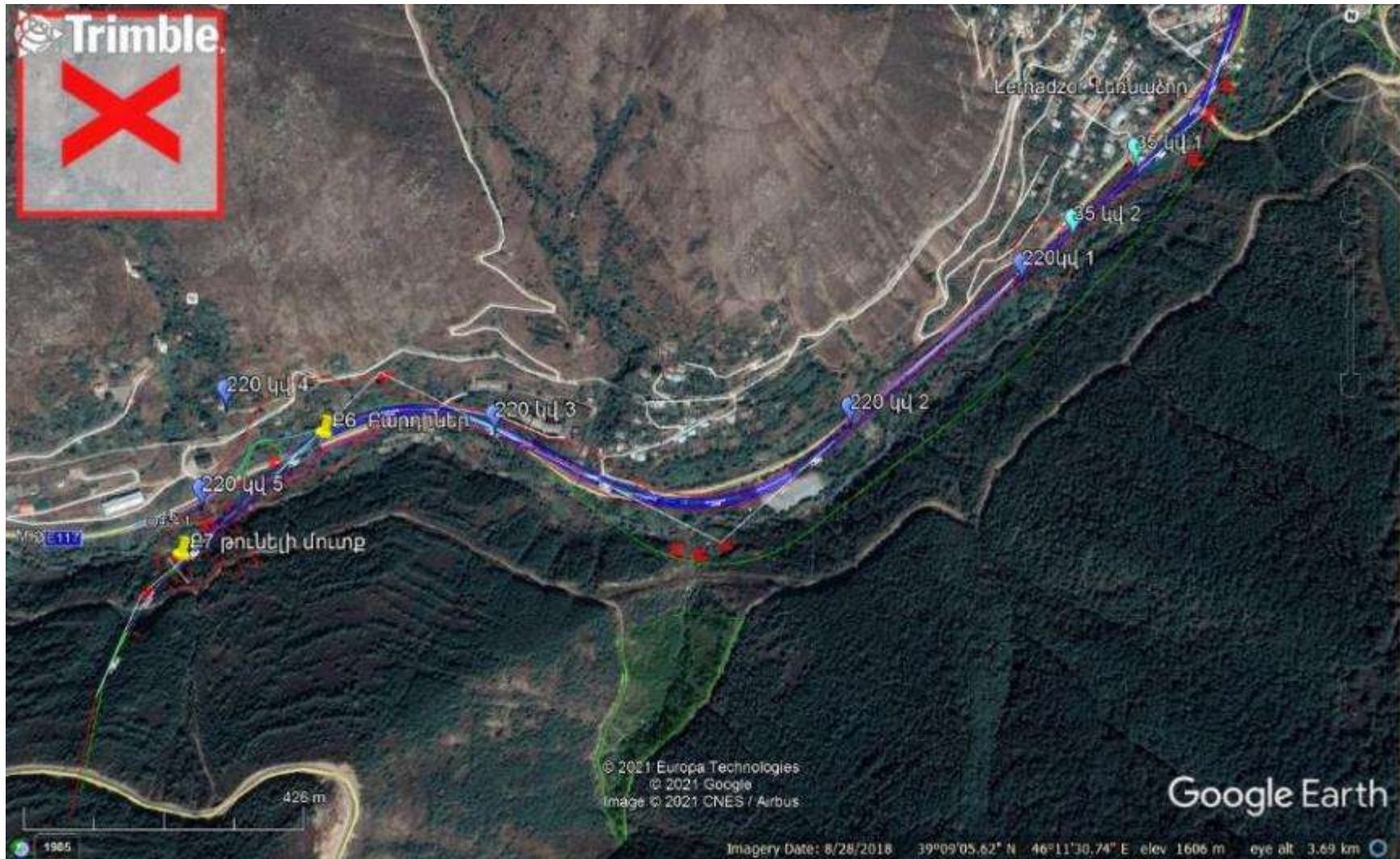


Figure 62: Google Earth program photo of the Lernadzor part of Kajaran - Vardanidzor section of North-South Highway, part-II



Table 35: Number of trees and shrub areas affected from the exit of the tunnel of the Kajaran-Vardanidzor section of the North-South highway to the Vank-Kaler crossroad

n/n	From conditional base point to base point	1-2	2 - 3	3 -4	4 - 5	5 - 6	6 - 7	7 - 8	8 – 10	Total	
1	Conditional base point coordinates	39° 05'14'' 46° 10'16''	39° 05'10'' 46° 10'18''	39° 05'07'' 46° 10'19''	39° 05'01'' 46° 10'28''	39° 04'58'' 46° 10'30''	39° 04'48'' 46° 10'39''	39° 04'46'' 46° 10'44''	39° 04'13'' 46° 11'14''		
2	Distance of conditional base points from each other, m	154	72	293	111	378	142	863	422		
3	Disturbed land area, m ²							5000			
4	Type of trees to be cut	Nest diameter, d, cm									
5	Walnut tree	6<d<10	-	-	-	-	-	-	1		
6		11<d<15	-	-	-	-	-	7	-		
7		16<d<20	-	-	-	-	-	-	-		
8		21<d<25	-	-	-	-	-	-	-		
9		26< d< more	-	-	-	-	-	1	-	1	
10	Trees to be cut (total)		-	-	-	-	8	-	2	10	
11	Oak grove	3<d<5	-	-	-	15	-	10	-	-	
12		6<d<10	-	18	28	-	-	-	11	-	
13		11<d<15	87	-	143	2	20	-	82	-	
14		16<d<20	27	-	12	-	32	-	-	-	
15		21<d<25	114	12	1	-	27	1	-	-	
16		26< d< more	4	4	4	8	28	5	3	-	
17	Trees to be cut (total)		232	34	188	25	107	16	96	-	
18	Prunus	3<d<5	-	-	-	1	-	-	-	-	
19		6<d<10	10	-	3	-	-	-	1	1	
20		11<d<15	15	8	-	-	2	4	2	-	
21		16<d<20	-	-	-	1	5	-	-	2	
22		21<d<25	-	-	-	-	2	-	1	-	
		26< d< more	11	5	-	3	7	-	4	8	
23	Trees to be cut (total)		36	13	3	5	16	4	8	11	
24	Fraxinus	3<d<5	-	1	-	5	-	-	-	-	
25		6<d<10	11	-	-	4	5	-	2	-	
26		11<d<15	-	-	1	2	-	1	-	-	



27		16<d<20	-	3	-	-	-	-	-	-	
28		21<d<25	-	-	-	-	2	-	-	-	
29	Trees to be cut (total)		11	4	1	11	7	1	2	-	37
30	Acer	3<d<5	-	-	-	-	-	1	-	-	
31		6<d<10	-	-	-	10	3	-	-	-	
32		11<d<15	-	1	-	3	12	-	-	-	
33		16<d<20	10	-	-	-	-	-	-	-	
34		21<d<25	12	5	-	-	-	-	-	-	1
35	Trees to be cut (total)		22	6	-	13	15	1	-	1	58
36	Willow	3<d<5	-	-	-	-	-	-	5	-	
37		6<d<10	-	-	-	-	-	-	4	-	
38		11<d<15	-	-	-	-	-	1	4	4	
39		16<d<20	-	-	-	-	-	3	7	10	
40		21<d<25	-	-	-	-	-	8	-	-	
41	26< d< more	12	-	-	-	4	-	2	14		
42	Trees to be cut (total)		12	-	-	-	4	12	22	28	78
43	Goat willow	11<d<15	-	15	-	-	-	-	3	11	
44		16<d<20	2	2	-	-	-	-	-	-	
45		21<d<25	-	-	-	-	-	-	-	2	
46		26< d< more	5	2	-	1	2	1	-	2	
47	Trees to be cut (total)		7	19	-	1	2	1	3	15	48
48	Other trees		30 /pine/	3 / hackberry /	3/ midland hawthorn /	2/malus/			2/juniper/		40
49	Disturbed lands										5000
50	Shrubs, m ²		50	30	40	15	60	15	200 / astragalus /		410 m ²
51	Total number of the trees to be cut										1067 piece



Table 36: Number of trees and shrub areas affected from the exit of the tunnel of the Kajaran-Vardanidzor section of the North-South highway to the Vank-Kaler crossroad by polygons / KMZ file attached /

n/n	Polygon	Polygon area, m ²	Foliage cover coefficient, FCC	Medium foliage area,	Estimated number of trees, NT	Forest area, m ²
1	P1	1362	0.4	8	68	1362
2	P2	2072	0.5	8	130	2072
3	P3	1255	0.5	8	78	1255
4	P4	4165	0.5	8	260	4165
5	P5	5029	-	-	-	shrub
6	P6	3135	0.4	7	179	3135
7	P7	14987	0.9	7	1927	14987
8	P8	1907	0.4	7	109	1907
9	P9	1886	0.5	7	135	1886
10	P10	13187	0.9	7	1695	13187
11	P11	4037	1.0	7	577	4037
12	P12	8178	0.8	7	935	8178
13	P13	6037	0.6	8	453	6037
14	P14	6586	-	-	-	shrub
15	P15	27547	0.4	7	1574	27547
16	P16	9558	-	-	-	shrub
17	P17	5439	-	-	-	shrub
18	P18	6595	0.5	7	471	6596, 1 piece of Platanus tree
19	P19	6067	0.4	8	303	6067
20	P20	8765	-	-	-	shrub, maybe privat
21	P21	8375	0.4	7	479	8375, maybe privat
22	P22	8496	0.4	7	485	8496
23	P23	19390	0.4	7	1108	19390, maybe privat
24	P24	20740	-	-	-	shrub
25	P25	10460	0.4	7	598	10460
26	P26	2559	-	-	-	shrub
Distrubed lands					-	
Shrubs					5 8676 u ²	



Tree (total)	11 564	
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Figure 63: The Google Earth program photo of Kajaran-Vardanidzor section of the North-South highway from the exit of the to the Vank-Kaler intersection, part-
I



Figure 64: The Google Earth program photo of Kajaran-Vardanidzor section of the North-South highway from the exit of the to the Vank-Kaler intersection, part-II



Figure 65: The Google Earth program photo of Kajaran-Vardanidzor section of the North-South highway from the exit of the to the Vank-Kaler intersection, part-III

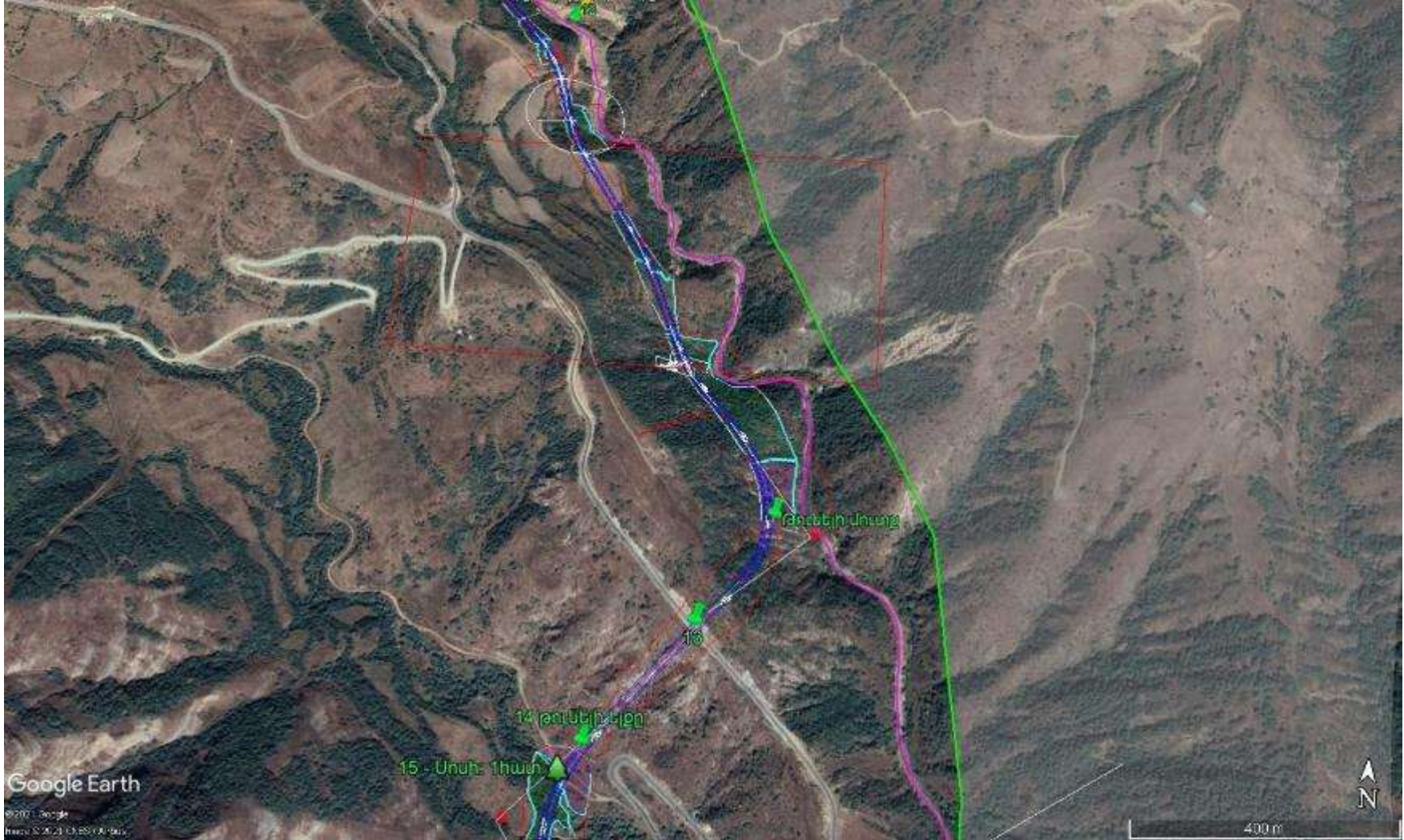


Figure 66: The Google Earth program photo of Kajaran-Vardanidzor section of the North-South highway from the exit of the to the Vank-Kaler intersection, part-IV

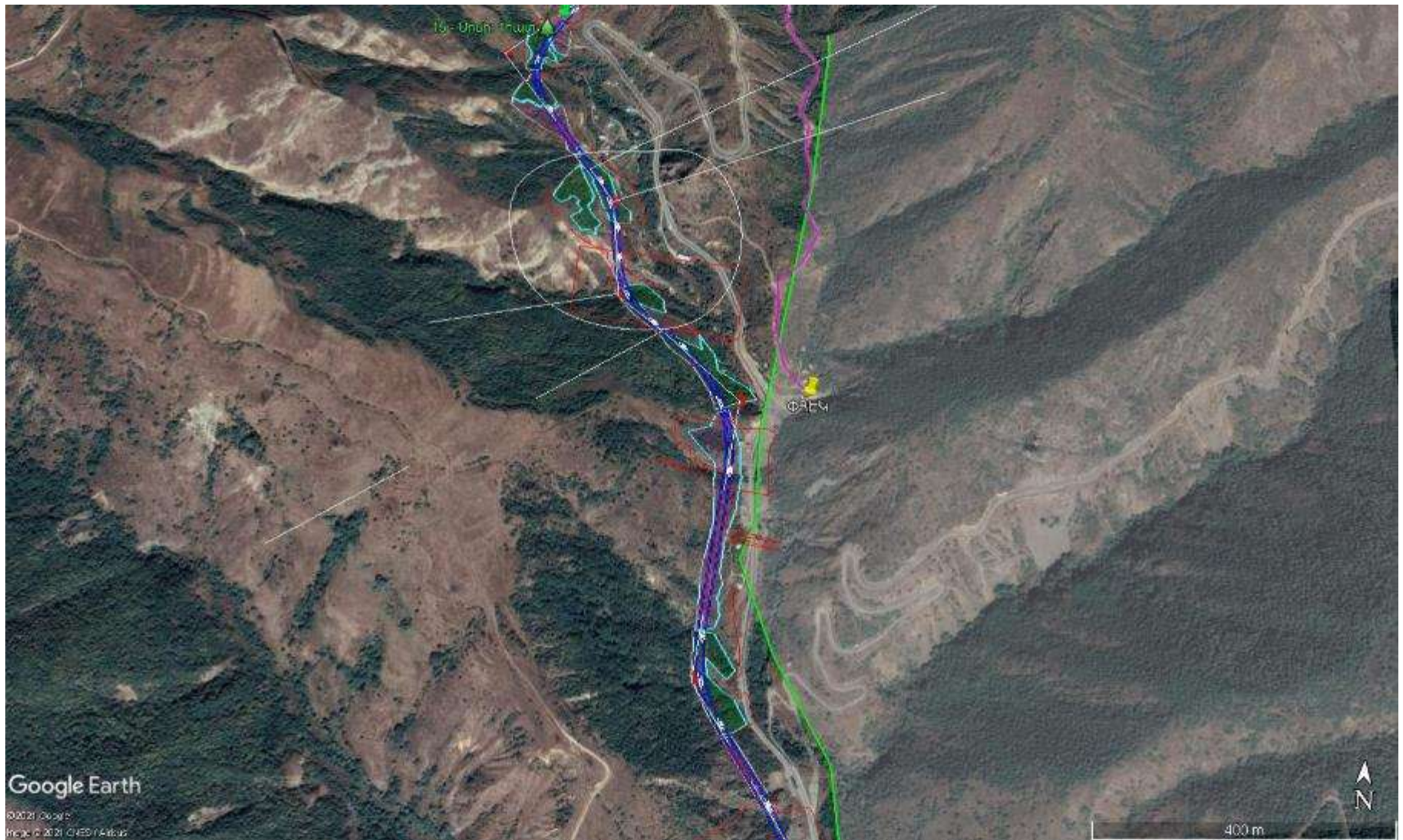


Figure 67: The Google Earth program photo of Kajaran-Vardanidzor section of the North-South highway from the exit of the to the Vank-Kaler intersection, part-V



Table 37: Number of affected trees and shrub areas in Kajaran-Vardanidzor section (Vank-Kaler intersection-Vardanidzor) of North - South Highway

n/n	From conditional base point to base point	20-21	22-23	23	26-27	River crossing	Platanus		Total
1	Conditional base point coordinates	38° 59'39'' 46° 12'23''	38° 59'46'' 46° 12'24''	38° 59'30'' 46° 12'24''	38° 59'01'' 46° 12'24''	38° 58'47'' 46° 12'35''	38° 58'41'' 46° 12'43''		
2	Distance of conditional base points from each other, m	-	-	-	-	-	-		
3	Type of trees to be cut	Nest diameter, d, cm							
4	Walnut tree	16<d<20	-	-	-	-	-		
5		21<d<25	-	1	-	-	-		
6		26< d< more	-	-	-	-	7	-	
7	Trees to be cut (total)		1	-	-	7	-		8
8	Fraxinus	6<d<10	1	-	-	-	-		
9		11<d<15	3	1	-	-	-		
10		16<d<20	-	1	-	-	-	-	
11	Trees to be cut (total)		4	2	-	-	-		6
12	Oak grove	3<d<5	-	4	1	-	-		
13		6<d<10	-	2	5	-	-		
14		11<d<15	-	2	-	-	-	3	
15		16<d<20	-	5	-	-	-	-	
16		21<d<25	-	52	-	-	-	-	
17	26< d< more	-	2	-	-	-	-		
18	Trees to be cut (total)		-	67	6	-	-	3	75
19	Acer	6<d<10	-	5	5	11	2	-	
20		11<d<15	-	-	1	-	3	-	
21		21<d<25	-	2	-	-	-	-	
22		26< d< more	-	4	1	-	-	-	
23	Trees to be cut (total)		-	11	7	11	5	-	34
24	Willow	3<d<5	-	-	-	10	-	20	
25		6<d<10	-	-	-	-	-	20	
26		11<d<15	7	-	-	15	-	6	
27		16<d<20	2	-	-	10	-	-	
28		21<d<25	-	-	-	4	7	2	
29	26< d< more	-	-	-	2	16	-		



30	Trees to be cut (total)		9	-	-	41	23	48		121
31	Morus	3<d<5	-	-	-	-	-	-		
32		6<d<10	-	-	-	-	-	-		
33		11<d<15	-	4	-	-	-	-		
34		16<d<20	-	-	-	-	-	-		
35		21<d<25	-	-	-	-	-	-		
36		26< d< more	-	-	-	-	-	-		
37	Trees to be cut (total)		-	4	-	-	-	-		4
38	Celtis	6<d<10	-	-	1	-	-	-		
39		11<d<15	-	-	-	-	-	-		
40		16<d<20	-	-	-	-	-	-		
41		21<d<25	-	-	3	-	-	-		
42		26< d< more	-	-	-	-	-	-		
43	Trees to be cut (total)		-	-	4	-	-	-		4
44	Elms	3<d<5	-	-	-	-	-	-		
45		6<d<10	-	-	12	2	-	1		
46		11<d<15	-	-	3	-	-	-		
47		16<d<20	-	-	-	-	-	-		
48		21<d<25	-	-	-	-	-	-		
49		26< d< more	-	-	-	-	-	-		
50	Trees to be cut (total)		-	-	15	2	-	1		18
51	Hazel	11<d<15	-	-	5	14	-	-		
52		16<d<20	-	-	-	-	-	-		
53		21<d<25	-	-	-	-	-	-		
54		26< d< more	-	-	-	10	7	-		
55	Trees to be cut (total)		-	-	5	24	7	1		37
56	Platanus orientalis	3<d<5	-	-	-	-	-	2		
57		6<d<10	-	-	-	-	-	1		
58		11<d<15	-	-	-	-	-	-		
59		16<d<20	-	-	-	-	-	-		
60		21<d<25	-	-	-	-	-	-		
61	26< d< more	-	-	-	-	-	-			
62	Trees to be cut (total)							3		3
63	Other trees		1 /morus/	2/cornus florida /	10 / cornus florida /	1/ cornus florida				18



				5/celtis/						
64	Disturbed lands									-
65	Shrubs									150 m ²
66	Total number of the trees to be cut									399

Table 38: Number of affected trees and shrub areas in Kajaran-Vardanidzor section (Vank-Kaler intersection-Vardanidzor) of North - South Highway by polygons /Կից ներկայացվում է KMZ ֆայլը/

n/n	Polygon	Polygon area, մ ²	Foliage cover coefficient, FCC	Medium foliage area, FM	Estimated number of trees, TN	Forest area, m ² Explanations
1	P27	4224	0.3	7	181	4224
2	P28	9518	-	-	-	shrubs
3	P29	16427	-	-	-	private area
4	P30	6421	-	-	-	shrubs
5	P31	22110	-	-	-	private area
6	P32	3886	0.3	6	194	3886
7	P33	8281	-	-	-	shrubs, 30 juniper trees
8	P34	27031	-	-	-	shrubs
9	P35	12027	-	-	-	settlement
10	P36	19771	-	-	-	shrubs
11	P37	11951	0.3	6	598+60	shrubs, 60 juniper trees
12	P38	4952	0.3	6	247	4952
13	P39	34453	-	-	-	Cultivated plots, Tkhut
14	P391	34266	-	-	-	private area
15	P40	7781	0.3	6	389	7781
16	P41	6332	-	-	-	6332
17	P42	21012	-	-	-	private area, Tkhut
18	P43	3345	-	-	35	shrubs, wild trees
19	P44	3229	-	-	52	shrubs, wild trees
20	P45	2621	-	-		shrubs till Tkhut
21	P46	10859	-	-	34	shrubs, wild trees
22	P47	19726	-	-	3 unuh	Shrubs



23	P48	10420	-	-	40	Disturbed lands
24	P49	9203	-	-	70	Disturbed lands
25	P50	17897	-	-	80	Disturbed lands
26	P51	7567	0.3	6	378	7567
27	P52	11565	-	-	50	private area, wild trees
28	P53	4698	-	-	20	private area, ecoton
29	P54	4758	-	-	40	private area, wild trees
30	P55	4349	-	-	30	private area, wild trees
31	P56	3493	0.3	6	174	
32	P57	3117	0.3	6	156	
Disturbed lands						5 1325 m ²
Shrubs						12 2753 m ²
Total						2771 tree

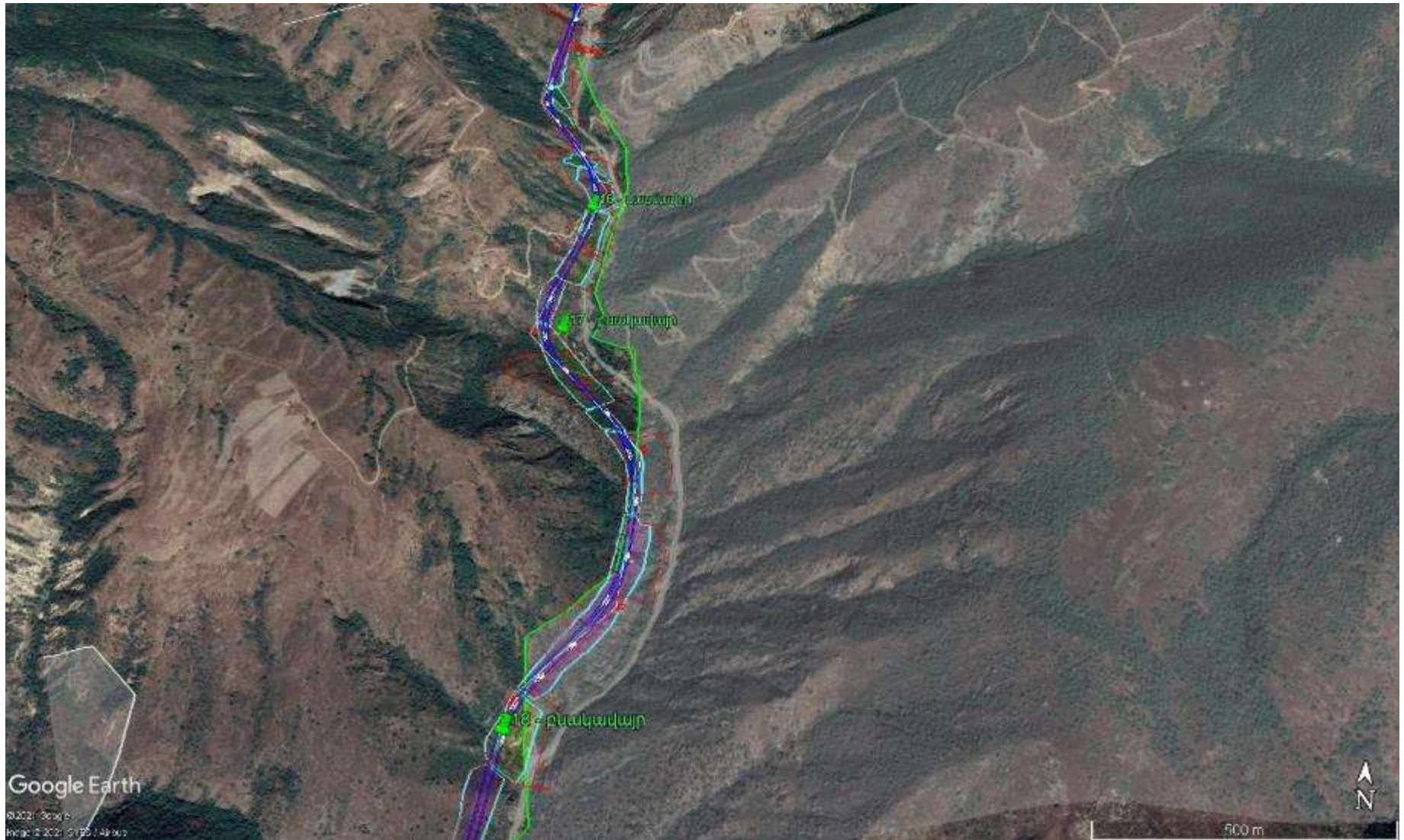


Figure 68: The Google Earth program photo of Vank - Kaler intersection to Vardanidzor part of Kajaran - Vardanidzor section of North - South Highway, part-I

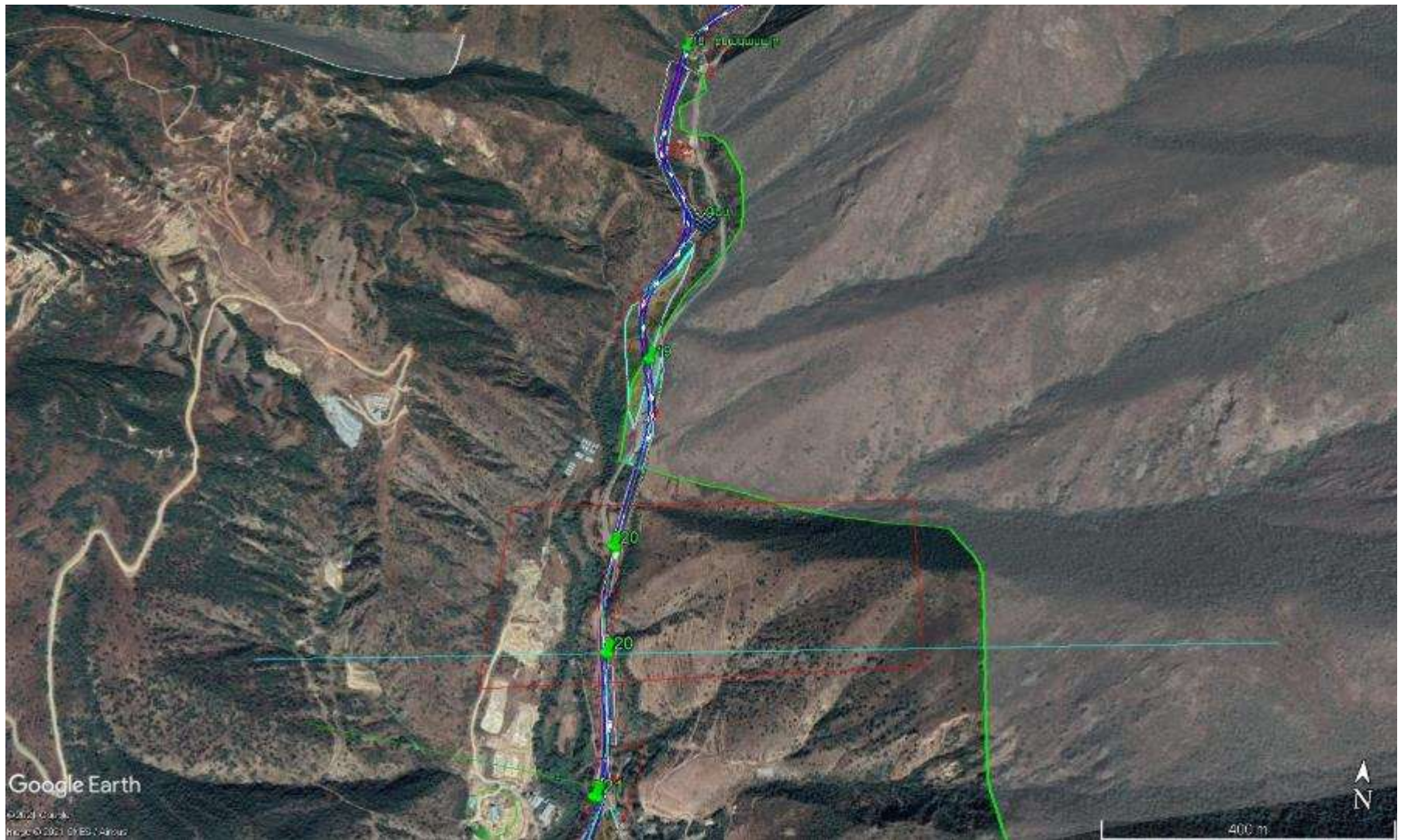


Figure 69: The Google Earth program photo of Vank - Kaler intersection to Vardanidzor part of Kajaran - Vardanidzor section of North - South Highway, part-II

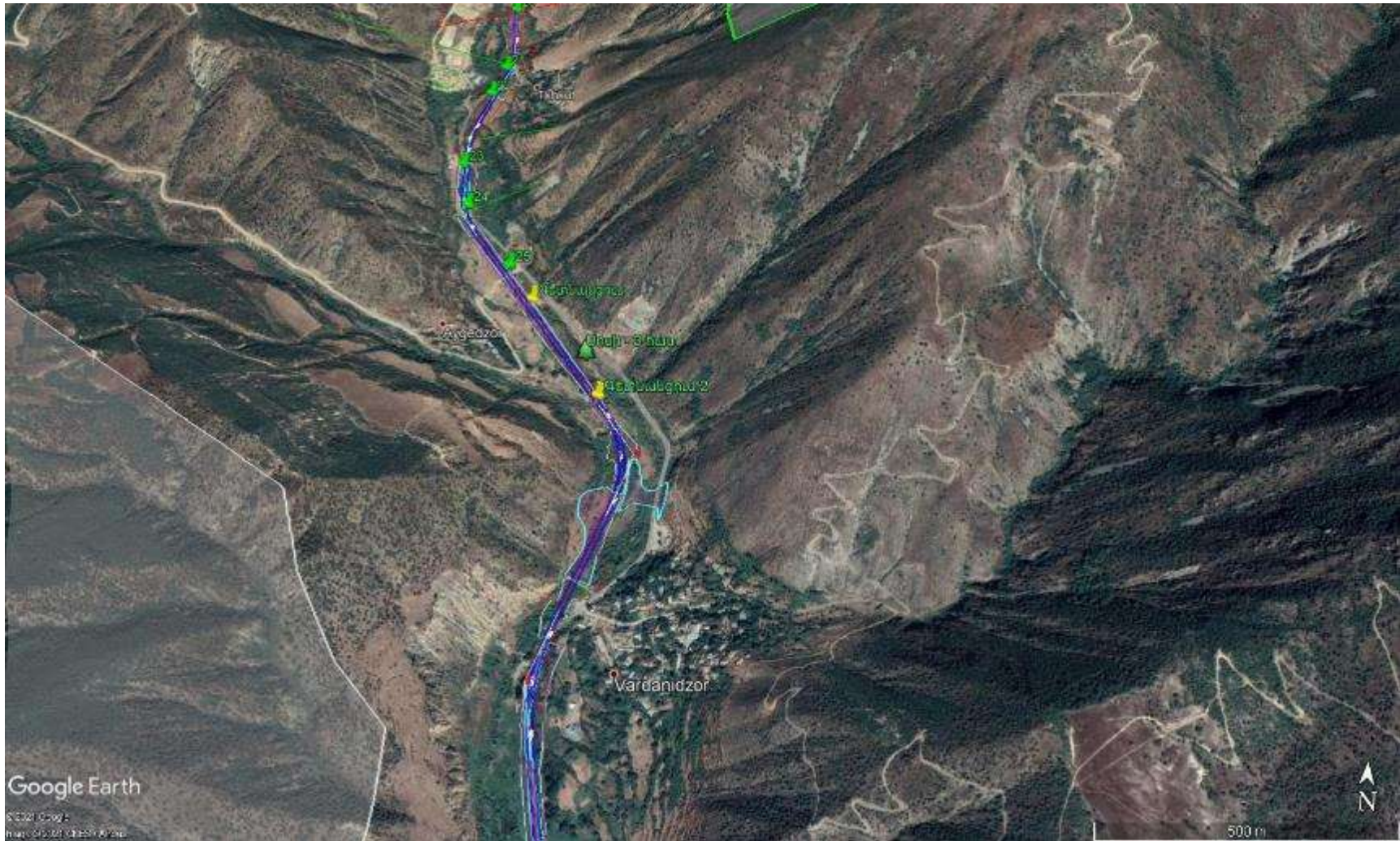


Figure 70: The Google Earth program photo of Vank - Kaler intersection to Vardanidzor part of Kajaran - Vardanidzor section of North - South Highway, part-III



Figure 71: The Google Earth program photo of Vank - Kaler intersection to Vardanidzor part of Kajaran - Vardanidzor section of North - South Highway, part-IV



Table 39: Summary of forest areas, number of shrubs and trees and disturbed lands in the Kajaran-Vardanidzor section of the North-South highway

h/h		Lernadzor - entrance to the tunnel	Tunnel entrance - Kaler intersection	Kaler intersection - Vardanidzor section	Total
1	The part of forest areas corresponding to the forest term	-	146439	34742	18 1181 m ²
2	Estimated number of trees in forest areas corresponding to the forest term	-	11564	2771	14335
3	Number of trees that do not form a forest	194	1067	1273	2534
4	Estimated number of forest area corresponding to non-forest trees	4527	24897	25460	5 4884 m ²
5	Total number of the trees	194	12631	4044	16869
6	Shrubs	420	58676	122903	181999
7	Disturbed lands	1250	500	51325	53075 m ²

Description of afforestation works

The selection of trees and shrub vegetation for afforestation will be done taking into account the species typical of the region. Import of invasive trees should be avoided. Particular attention should be paid to the possibility of restoring Red Book trees. According to our research, the following trees are typical of the region: Quercus iberica, Quercus macranthera, Carpinus orientalis, Fraxinus excelsior, rarely happens Euonymus latifolia: Pine /Pinus/ tree species can be used for afforestation. From shrub species Crataegus pseudoheterophylla, Crataegus ripidophylla, Rosa, Cotinus coggygia, Barberis vulgaris can be used and from fruit trees - Prunus divericata: It is recommended to do afforestation with these mentioned species. It is proposed to establish Platanus orientalis parks in the river valleys of the Meghri river. Several individuals of this tree species have been found in the Meghri river valley as a result of field research.

According to the decision N1045-N approved by Government of the Republic of Armenia in 30.08.2007, after concluding a contract on the use of forest lands, the forest user shall submit a program on compensation for damage to the forest economy (hereinafter referred to as the program) within three months for the approval of the authorized state body. The end of the project implementation is considered to be the day of transferring the forest landscapes established during afforestation to the forest line in the manner prescribed by the RA legislation (but not later than 60 years).



Table 40: Summary of the forest areas, the number of shrubs and tree sand disturbed lands in the Kajaran-Agarak section of the North-South highway

h/h		Lernadzor - entrance to the tunnel	Tunnel entrance - Kaler intersection	Kaler intersection - Vardanidzor section	Vardanidzor - Agarak section	Total
1	Estimated number of trees in forest areas corresponding to the forest term	-	11564	2771	1995	16330
2	Number of trees that do not form a forest	194	1067	1273	502	3036
3	Total number of the trees	194	12631	4044	2497	19366
4	Shrubs, m ²	420	58676	122903	3660	185659
5	Disturbed lands, m ²	1250	500	51325		53075
6	Total forest area					173,971 m ²
7	Specially protected areas					34,597 u2

This report also presents some afforestation / reforestation sites in the form of Google Earth photos. It should be noted that the presented precincts were selected as a result of the study together with the representatives of the affected communities.

Table 41: Data on proposed afforestation and reforestation sites

n/n	Site name	Site area, ha	Site height, above sea level	The coordinates of the middle part of the site	Proposed main types of trees
1	Platanus-1	6,15	950	38°57'08.15"N 46°12'38.39"E	Platanus orientalis
2	Platanus -2	5,9	1015	38°57'57.54"N 46°12'46.69"E	Platanus orientalis
3	Platanus -3	6,3	1120	38°57'08.87"N 46°12'38.47"E	Platanus orientalis
4	Pine-1	9,1	1650	39°02'55.02"N 46°11'48.50"E	Types of Pine
5	Pine and oak-1	19,6	1840	39°02'55.72"N 46°11'05.28"E	Pine, Oak glove and Georgian oak
6	Pine and oak -2	16,7	1760	39°02'16.99"N 46°11'31.35"E	Pine, Oak glove and Georgian oak
7	Pine and oak -3	15,0	1610	39°02'35.40"N 46°12'04.60"E	Pine, Oak glove and Georgian oak
8	Pine and oak -4	4,4	1530	39°01'51.09"N 46°12'14.41"E	Pine, Oak glove and Georgian oak
	Total area, ha	82,15	-	-	-



Figure 72: Photos of proposed afforestation / reforestation sites with Google Earth. In these areas it is recommended to plant trees mainly with oak, ash (fraxinus) and pine trees.



Figure 73: Photos of proposed afforestation / reforestation sites with Google Earth. In these areas it is recommended to plant trees mainly with *Platanus orientalis*.



Figure 74: Photos of proposed afforestation / reforestation sites with Google Earth. In these areas it is recommended to plant trees mainly with oak, ash (*fraxinus*) and pine trees.



ANNEX 9: STUDY OF HISTORICAL-CULTURAL AND ARCHAEOLOGICAL RESOURCE

Study of monuments of archaeological, historical-architectural and paleontological significance along Kajaran-Agarak section of the North-South Road Corridor Investment Program (Tranche 4, Lot 1 and Lot 2)

While studying the archaeological, historical-architectural and paleontological resources along the alignment of the Kajaran-Agarak road section construction project (North-South Road Corridor Investment Program, Tranche 4, Lot 1 and Lot 2) three different information sources were used: 1) State List of the Immovable Monuments of History and Culture of the Republic of Armenia, Syunik Province (RA Government's decision on 29th December 2005, №2322-N); 2) the results of several archaeological missions carrying out research in the study area between 1970-1990; 3) the results of field investigations or survey implemented along the alignment with an aim to record the sources of archaeological, historical-cultural and paleontological significance in the area related with the proposed alignment.

The aim of the field investigations in the targeted area was to record the sources, which have archaeological, historical-architectural, paleontological and spiritual significance for the proposed design of the road. Those works were carried out within the time frame including two separate phases for Lot 1 and Lot 2, from 20.04.2021 until 20.07.2021. The team, which implemented the field investigations or the survey, consisted of a team leader, three archaeologists and one topography specialist. The members of the team implemented intensive survey along the whole alignment (Lot 2 Pk 0.00 – Pk 26.5 and Lot 1 Pk 26.5 – Pk 42.3, 42.300 km in total), which was provided by the project designer (Maps 75 and 76) and recorded whole information by using GPS coordinates, including visible constructions, surface finds, sections, natural structures, etc., which were related directly with the alignment or located in the close proximity of the future road alignment. The alignment was adopted on GIS based 10 m resolution raster maps (ArcGIS 10.4), after which the impacted archaeological sites and historical-cultural monuments recorded during the fieldwork activities were selected along the targeted areas as conventional separate units. This operation allowed us targeting the sites which will be under the direct impact or stay under the Right of Way (RoW) and the sites which will not directly affected, but will be under the danger of destruction or can be affected during the construction process.

The collected information was compared with the State List of monuments of the Syunik Province to clarify the status of the recorded unit – known and recorded site or newly discovered. For dating of the site's pottery fragments, obsidian implements and other possible artifacts collected, were cleaned, studied and evaluated. Meanwhile, the units or sites were reflected on GIS based Maps (with separate sheets by 1:10 000



scale) and provided by color division of the community, by its position to the community, and to the alignment divided by Pk.

The recorded units were also provided by their typological classification: necropolis, cemetery, shrine, church, fortress, settlement, bridge etc. – units of archaeological, historical-architectural and spiritual significance (see the Legend in Table 42). As a result of the above-mentioned activities 19 units in total were recorded and allocated along the alignment (Figures 75 and 76), which are reflected on 46 Figures (see Figures 75-76 – 121-122), as well as by a separate list (Table 42). Herein, the recorded units are described one by one, by the numbers, by the possession to the community land and by position to the pk division of the road project design.

Their distribution of the units in the report is organized by the following way: each site or group of sites are listed belonging to the corresponding community (for example Syunik Province, Tashtun community), by its type (i.e. necropolis, cemetery, settlement, fortress, church, bridge etc.) and with a description of its location (4 km south-east from the village or from the community center), with additional information if available (on the hilltop, on the slope, near the river bed, on the terrace, near the junction of the roads leading to the communities, etc). For all the sites or units targeted in the list GPS coordinates are provided for their accurate allocation. For each unit the State List also provides special codes or numbers (for example 8.38.1., where 8-is the Province Number, 38 is the community number, and 1 is the number of the site in the community – i.e., 8. Syunik Province, 38.the village of Lernadzor, 1. Settlement). The lists also contain dating of the site (for example IV – III Millennium BC, VII– VI centuries BC, V-XIII centuries, etc.). The listed units, which are located in the nearby areas or in the close proximity of the proposed alignment, are highlighted in yellow in the State list of the monuments (provided separately).

As a whole, the alignment of the proposed 42.300 m long section of the Kajaran-Agarak highway (Tranche 4, Lot 1 and Lot 2) will pass through administrative boundaries of nine (9) settlements, which are: Lernadzor, Tashtun, Lichk, Lehvaz, Vardanidzor, Gudemnis and Karchevan villages and Kajaran and Meghri cities (Figures 75 and 76), from which 6.95 km will pass through the tunnel (Pk 3.5 – Pk 10.45) in the administrative limits of the Lernadzor, Kajaran and Tashtun communities (Figures 75 and 76).

Hereby the description on each recorded unit is provided separately by their location in communities and in relation to the corresponding Pk of the alignment.



Lernadzor village (Lot 2, Pk 0.0 – Pk 3.0 and Pk 5.1 – Pk 7.63, Maps 75-76, 77-78 – 83-84, Images 1-10).

As it is visible from the comparison of the road alignment and the features recorded during the fieldwork investigations, in the limits of the Lernadzor Community, three (3) monuments with historical-cultural significance are recorded, which will be affected during the project implementation (units 001, 002 and 003). Those are: Lernadzor Necropolis (unit 001), Lernadzor Archaeological Complex (unit 002) and Old Lernadzor village remains (unit 003).

The VII-VI centuries BC Lernadzor Necropolis (unit 001, Table 42) is located at the north-north-eastern ending of the village and was partly destroyed during the highway construction leading to Kajaran. Archeologist O. Khnkikyan established safeguard archaeological excavations here, when during the above-mentioned construction activities, a grave dating back to the XI-X centuries BC was discovered. The unit is included in the State list of Syunik Province monuments under 8.38.8. code. In the survived portion of the necropolis, on the left side of the functioning Kajaran highway traces of existing and partially destroyed grave structures are still visible (Pictures 1-2).

Comparison of the proposed road alignment and the recorded portion of the necropolis, making obvious that this unit will be directly affected by the future construction activities in the section between Pk 0.4 – Pk 0.7 (Maps 77-78). The only way to preserve the cultural-historical value of this site is the implementation of archaeological excavations of the graves, which will be directly affected during the future construction activities. The precise amount of the features included in future excavations will be defined during the next step of the project implementation, when the maximum destruction zone of the construction activities will be identified.

Next unit, which is recorded in the limits of the Lernadzor Community is the Lernadzor Archaeological Complex (unit 002), represented by destroyed Late Classical or Early Medieval period (IV-V centuries AD) necropolis with cist graves, overlying a layer with Chalcolithic period (last quarter of the V Millennium BC) settlement, as well as a Late Upper Paleolithic (14-13 thousand years BP) site, around 1 m below it, at the base of the exposed section. As one can see from the exposed section by the heavy machinery, above mentioned 3 archaeological phases or layers are very well preserved, among which the most valuable is the Upper Paleolithic site, as it has no parallels yet in the territory of Armenia (Pictures 3-6). The complex is included in the State list of the Syunik Province monuments as a Chalcolithic-Early Bronze Age settlement and necropolis under the code 8.38.1. (Table 42). The site is located north-east from the village, 1-1.5 km left from the highway leading to Kajaran, in the former cattle farming area of the village. With the proposed road alignment, it is related in the



point Pk 0.95, but will be not affected directly by the future construction activities (Maps 77-78). For this reason, unit 002 requires protection rules established for the sites with indirect impact during the road construction activities. Independently to what was mentioned above, more problematic is the high voltage line metal column, which was formerly erected above the surface of the site and nowadays being heavily damaged and bent and can become a danger for local people and more for the researchers, who aim to conduct some work here in the future. It is necessary to remove or to allocate this metal construction, which will solve the security question, giving a chance to organize future study of this important cultural unit.

Next unit recorded in the limits of the same community is Old Lernadzor village remains (unit 003). It is represented by remnants of XVII-XVIII centuries dwelling area, church (S. Astvatsatsin, 1661) and a cemetery adjacent to the church. In the State list of the Syunik Province monuments the site is recorded under codes 8.38.5., 8.38.5.1., 8.38.5.2. (Table 42). It surrounds top of a hill situated 1.5-2 km east-north-east from the village, in the forested area (Pictures 6-10). With the road alignment the unit is related in the point Pk 1.2. It is located on a secure distance from the future construction activities area and is not directly affected. For this reason, unit 003 requires protection rules established for the sites with indirect impact during the road construction activities (Figures 77-78).

Kajaran city (Lot 2, Pk 3.0 – Pk 5.1, Figures 75-76, 79-80 – 81-82). Starting from Pk 3.0 the proposed road alignment enters the area of the Kajaran Community and continues till Pk 5.1, after which, at Pk 3.5 it enters the tunnel and appears again in the administrative area of the Lernadzor Community (Figures 79-80 – 81-82). In the limits of the Kajaran Community areas related with the road alignment lack units having archaeological and/or historical-cultural significance, which means that there are no cultural barriers in corresponding section for implementation of the road construction activities.

Tashtun village (Lot 2, Pk 7.63 – Figures 75-76, 85-86 – 91-92, Pictures 11-14). In Tashtun community the proposed alignment of the highway is starting from Pk 7.63, continuing to pass through the tunnel section until Pk 10.45, after which it reaches Pk 14.3 entering the area of the next Lichk community.

As it is visible from the comparison of the road alignment and the features recorded during the fieldwork investigations, in the limits of the Tashtun Community, two (2) monuments with historical-cultural significance are recorded, which will be affected during the project implementation (units 004 and 005). Those are: uncertain structure remnants (unit 004) and Late Medieval period bridge of Tashtun (unit 005).



The uncertain structure remnants (unit 004, Table 42) are situated around 4 km north-east from the village, on the right bank of the Meghri River. They are almost covered by sediment and it is not possible to identify their type and function. They can be a fragment of an ancient road or a terrace feature of an ancient garden. The unit is not included in the State list of Syunik Province monuments (Pictures 11-12).

As it is visible from the comparison of the road alignment and the newly discovered feature during the fieldwork investigations, it will be directly affected during the future road construction activities at Pk 11.3 (Figures 87-88). For saving the cultural-historical value of the newly discovered unit test excavations are required, the goal of which is to clean the feature from the sediment, to understand which type of archaeological monument it belongs, the chronology and then, to come up with the final safeguard measures.

Next recorded unit in the Tashtun Community which is related to the proposed alignment is the Late Medieval period bridge of Tashtun (unit 005). It is represented by one-winged bridge, built in XVII-XVIII centuries from local stone over the Meghri River (Pictures 13-14). The bridge is included in the State List of the Syunik Province monuments under the 8.100.5. code (Table 42). It is situated 3 km north-east from the village, left from the functioning Kajaran-Meghri highway. With the road alignment it is related in the point Pk 13.1 (Maps 89-90). Standing in close proximity of the functioning highway and the area of future road construction activities, the Late Medieval bridge of Tashtun can be affected in a negative way. For protection of its historical-cultural value of the structure special measures will be required during the construction activities. Taking into consideration the critical state stability of the bridge, a special construction activities and procedures must be implemented excluding vibration. It is also possible to require building a protection wall between the bridge and the highway, which has to be discussed with architects, engineers and other specialists.

Lichk village (Lot 2, Pk 14.3 – Pk 20.85, Figures 75-76, 91-92 – 97-98, Pictures 15-18). The proposed road alignment is passing through the boundaries of the Lichk Community between Pk 14.3 and Pk 20.85.

As it is visible from the comparison of the road alignment and the features recorded during the fieldwork investigations, in the limits of the Lichk Community also two (2) monuments with historical-cultural significance are recorded, which will be affected during the project implementation (units 006 and 007). Those are: Late medieval period bridge 1 (unit 006) Late medieval period bridge 2 (unit 007), both constructed on the Meghri River.



The Late medieval period bridge 1 of Lichk (unit 006) is similar to the Tashtun bridge and is a one-winged construction built from the local stone during XVII-XVIII centuries (Pictures 15-16). The bridge is not included in the State list of Syunik Province monuments (Table 42). It is located approximately 1.8 km east-south-east from the village, on the left side of the functioning Kajaran-Meghri highway. With the road alignment it is related in the point Pk 14.85 (Figures 91-92). Standing in close proximity of the functioning highway and the area of future road construction activities, the Late Medieval bridge 1 of Lichk can be affected in a negative way. That's why, like in the case of the Tashtun bridge, for the protection of its historical-cultural value similar special measures will be required during the construction activities.

The situation is more complicated in case of the Late medieval period bridge 2 of Lichk (unit 007), which is situated 5.8 km south-east from the village, on the left side of the Kajaran-Meghri functioning highway. The bridge 2 is similar to the previous one, but has smaller proportions and was affected during the construction of the highway (Pictures 17-18). The bridge is not included in the State list of Syunik Province monuments (Table 42). With the road alignment it is related in the point Pk 20.45 (Figures 97-98). Standing in close proximity of the functioning highway and the area of future road construction activities, the Late Medieval bridge 2 of Lichk can be affected directly, staying under the cover of the left side infilling of the proposed highway. The question of protection of the historical-cultural value of the unit must be discussed with the company responsible for the design and to propose to change the configuration of the infilling, after which similar special measures will be required during the construction activities.

Lehvaz and Vardanidzor villages (Lot 2, Pk 20.85 – Pk 26.5, Lot 1, Pk 26.5 – Pk 31.0, Maps 75-76, 97-98 – 109-110, Pictures 19-33). After Lichk the road alignment will pass through the borders of the Levhaz and Vardanidzor communities at Pk 20.85, then entering the area of the Vardanidzor Community at some section it will change the location passing from one community to another until Pk 31, after which it will enter the administrative area of the Gudemnis Community.

Fieldwork investigations recorded the maximum number of units with archaeological and historical-cultural significance for this section of the project with 10.15 km of length. Total amount of the units recorded here is ten (10), which are 008, 009, 010, 011, 012, 013, 014, 015, 016 & 017, majority of which - eight (8) units belong to the area of the Vardanidzor Community, and 2 (two), correspondingly, to the Levhaz Community. Those are: Late medieval bridge of Vardanidzor (unit 008), khachkar-1 (unit 009), uncertain structure remnants 1 (unit 010), Pushkag medieval village remains (unit 011), khachkar-2 (unit 012), terrace system of old



horticultural landscape (unit 013), structure remnants 2 or medieval village remains 2 (unit 014) and uncertain structure remnants 3 (unit 015), Lehvaz cemetery (unit 016) and water mill (unit 017).

The Late Medieval bridge of Vardanidzor (unit 008) is similar to the previous ones and is a one wing structure, built from the local stone in XVII-XVIII centuries (Pictures 19-20). It is not included in the State list of Syunik Province monuments (Table 42). The bridge is situated 4 km north-north-west from the village, on the left side of the functioning Kajaran-Meghri highway, on the Meghri River. With the road alignment it is related in the point Pk 20.95 (Figures 97-98). Standing in close proximity of the functioning highway and future road construction activities, the Late Medieval bridge of Vardanidzor can be affected in a negative way, which happened in Soviet period, during the construction of the functioning highway, when the left portion of the bridge was shortened staying under the road. That's why, like in the case of the previous bridges (like for example the Tashtun bridge), for the protection of its historical-cultural value similar special measures will be required.

Khachkar-1 (unit 009), also located in the administrative limits of Vardanidzor community, is a modern monument and is standing directly left from the functioning Kajaran-Meghri highway. It is not included in the State list of Syunik Province monuments, but has some cultural and aesthetic significance (Table 42). With the road alignment it is related in the point Pk 23.43 (Figures 101-102). Standing in close proximity of the functioning highway and under the direct impact of the future road construction activities, this khachkar can be removed for some time to a secure place and re erected closer to the new highway at the same place.

Uncertain structure remnants 1 of Vardanidzor (unit 010) is represented by a group of not regular and circular in plan structures, spread close to each other with 2-2.5 m its diameter. They can be prehistoric burials with high probability (Pictures 21-22) and are located 1.6 km north-north-west from Vardanidzor, on the left side of the functioning Kajaran-Meghri highway. Meanwhile, for the described place nothing is available in the State list of monuments of the Syunik Province (Table 42). With the road alignment this unit is related in the point Pk 23.62 (Figures 101-102) and is appearing directly under the impact of future construction activities. The only possibility to save the historical-cultural value of the unit are archaeological excavations, but for the definition of the real impact on the site precise measurements are required, which will be established during the next, construction step of the project.

Next unit which is recorded in the limits of the Vardanidzor Community is XVIII-XX centuries Pushkag village remains (unit 011), which is heavily destroyed together with its cemetery. Traces of the houses with



adjacent structures are visible in a shape of collapsed walls. It is located 1.3 km (1.5 km according to the State list) north-west from Vardanidzor, on the bank of the Meghri River, on the right side of the functioning Kajaran-Meghri highway (Pictures 23-24). The site is included in the State list of the Syunik Province monuments under codes 8.92.4. Լ 8.92.4.1. (Table 42). With the road alignment this unit is related in the point Pk 23.85 (Figures 101-102) and will appear in the future construction activities area carrying direct impact. The only possibility to save the historical-cultural value of the site are archaeological excavations, but for the definition of the real impact on the site precise measurements are required, which will be established during the next, construction step of the project.

Next units after the Pushkag village remains are khachkr-2 (unit 012) and the terrace system of old horticultural landscape (unit 013). As the previous one, this khachkar is a modern monument and is erected on the left side of the functioning Kajaran-Meghri functioning highway. It is also not included in the State list of the Syunik Province monuments, but has some cultural and aesthetic significance (Table 42). With the road alignment it is related in the point Pk 24.8 (Figures 103-104). Standing in close proximity of the functioning highway and under the direct impact of the future road construction activities, this khachkar can be removed for some time to a secure place and re erected closer to the new highway at the same place.

Unit 013 is represented by another unique example of ancient horticultural landscape, like are the other terrace system structures of the Meghri district as a whole, which unfortunately, did not receive corresponding evaluation during previous studies of the area and were not included in the State list of Syunik Province monuments, even they differ from the other similar systems of the territory of Armenia (Table 42). They are characteristic for the landscapes with strong slopes and limited soil resources. Located 300 m north from the village of Vardanidzor, on the left side slopes of the functioning Kajaran-Meghri highway, these terrace structures are preserved very well (Pictures 25-26). With the road alignment it is related in the point Pk 24.9, where the community cloverleaf will be constructed and there is a danger of direct impact on the elements of the unit (Figures 103-104). For saving the historical-cultural value of this and similar monuments, the only possibility is their partial drawing and record with aerial photography, which must be fixed as a precondition for this section of the road in front of the contractor.

Next cultural feature in the limits of the Vardanidzor Community is the structure remnants 2 or medieval village remains 2 (unit 014), which was recorded on the left side of the functioning Kajaran-Meghri highway, 700 m south-south-west from the village, and is located in the area of the gardens spread on the left embankment



of the Meghri River. More probably, this site is representing another, partly destroyed Medieval village remains, which is not recorded in the State list of Syunik Province monuments. Here traces of dwellings and other structures are visible on the ground (Table 42, Pictures 27-28). With the road alignment the unit is related in the point Pk 25.95, where reconstruction of the functioning highway is proposed. It is located on a secure distance from the future construction activities area and is not directly affected. For this reason, unit 014 requires protection rules established for the sites with indirect impact during the road construction activities (Figures 103-104).

The last recorded unit of historical-cultural significance for the Vardanidzor Community is the uncertain structure remnants 3 (unit 015), which was again recorded in the left proximity of the Kajaran-Meghri functioning highway, approximately 1.2 km south-south-west from the village, on the left bank of the Meghri River. This uncertain, nearly almost destroyed feature is probably representing a wall fragment or portion of a burial chamber and is not included in the State list of Syunik Province monuments (Table 42, Picture 29). With the road alignment the unit is related in the point Pk 26.45, where reconstruction of the functioning highway is proposed (Figures 103-104). Even though, due to its location the unit is not being directly affected, here test excavations will be required, as of if the feature is a destroyed tomb, there can be other ones in the neighborhood, which can be directly affected during the future road construction activities.

First unit recorded in the limits of the Lehvaz Community (unit 016) is represented by partly destroyed XVII-XX centuries cemetery, which is located 1 km north-east from the village, traces of which are visible on the left side slopes of the Kajaran-Meghri functioning highway (Pictures 30-31). The cemetery is included in the State list of Syunik Province monuments under the 8.37.1. code (Table 42). With the road alignment the unit is related in the point Pk 28.7 and judging from its location it is not being affected during the implementation of the project. This is why unit 015 requires protection rules established for the sites with indirect impact during the road construction activities (Figures 107-108).

The next and last unit, which is recorded in the limits of the Lehvaz Community, is the XIX century water mill (unit 017), which is located at the south-eastern ending of the village, not far from the confluence of the Meghri and Vahravar rivers. The construction lost its initial view because of multiple reconstruction during later periods, but still is functioning as a water mill (Pictures 32-33). In the State list of Syunik Province monuments this structure is recorded under the 8.37.5. code (Table 42). With the road alignment the unit is related in the point Pk 29.16, in the limits of the community cloverleaf proposed here by the project alignment. Based on the



location of the water mill, it can carry negative impact or will be directly affected by the construction activities. That's why during the next of the project safeguard measures are required to protect the structure from destruction (Figures 107-108).

Gudemnis village (Lot 1, Pk 31.0 – Pk 31.6, Figures 75-76, 109-110, Pictures 34-35). After Vardanidzor the road alignment will pass in the limits of the Gudemnis Community, through a 600 m section starting in Pk 31.0 until Pk 31.6, where it will enter the area of the Meghri Community.

In the above-mentioned road section, during the fieldwork investigation activities a single unit (unit 018) is recorded, which is represented by one more, a very well-preserved terrace system of the ancient horticultural landscape. The last was not included in the State list of Syunik monuments as well (Table 42). It is spread on the left bank of the Gudemnis River, at its confluence with the Meghri River, 4 km south-east from the village (Pictures 34-35). With the road alignment it is related in the section Pk 31.1 – Pk 31.4, and some portions of it will be directly affected during the future construction activities. That is why for preservation of the value and completeness of the unit it has to be recorded through the implementation of measurements, drawing and aerial photography (Figures 109-110).

Meghri city (Lot 1, Pk 31.6 – Pk 39.46, Figures 75-76, 109-110 – 117-118, Pictures 36-39). Coming out from the limits of the Gudemnis Community the road alignment, due to the design, starting from Pk 31.6 is entering the area of the Meghri Community and passing a distance of 7.86 km at Pk 39.46 is reaching the area of the Karchevan Community.

In the limits of the Meghri Community, while investigating the areas related with the road alignment, only a single unit (unit 019) with historical-cultural significance was targeted. This unit is the Pokr Tagh district, which is part of the historical-architectural and horticultural ancient landscape of the city of Meghri and is represented by ethnographic houses of the XIX and the beginning of the XX century as well as S. Sargis church built in XVII century. The church is a three-neff basilica, which interior preserves frescoes from the same period (Pictures 36-39). Pokr Tagh occupies the north-eastern part of the city, spread on the right embankment of the Meghri River. In the State list of Syunik monuments, it is recorded under the code 8.5.2., with corresponding subunits (codes 8.5.2.1. - 8.5.2.20.), (Table 42). With the road alignment Pokr Tagh complex is related with a section between Pk 34.3 to Pk 35.3, which is approximately 1 km long and bypasses the district from the west (Figures 113-114). The units forming the complex have close location to the future construction activities zone. Even though they are not directly affected there can be some risks for the preservation of their cultural value.



Taking into consideration the exceptional cultural importance of the Pokr Tagh, as well as the role it can play for the future development of tourism in Meghri, special safeguard measures are required for the above-mentioned section of the construction activities. It must be also considered that S. Sargis church preserves valuable frescoes, which can suffer from the vibration caused by road construction activities.

Karchevan village (Lot 1, Pk 39.46 – Pk 42.3, Figures 75-76, 117-118 – 121-122). The final portion of the alignment will pass through the area of Karchevan Community, starting from Pk 39.46 up to Pk 42.3, where it will reach the end (Figures 117-118 – 121-122). In the limits of the Karchevan Community areas related with the road alignment there are units having archaeological and/or historical-cultural significance.

As a whole, 19 units of archaeological and historical-architectural significance are allocated and recorded along the alignment of the Kajaran-Agarak section of the North-South highway (Table 42). They are representing the resources of the historical-cultural heritage, which can be affected directly and indirectly during the implementation of the project. Based on the proposed alignment the following ten (10) units will carry direct impact, which are numbers 001, 004, 009, 010, 011, 012, 013, 015, 017, and 018 (Table 1), and are represented by a necropolis, uncertain structure remnants (probably burials, traces of ancient roads, production facilities in the vineyards and dwellings), khachkars, etc. Their historical-cultural value can be saved through archaeological excavations, aerial photography, measuring and other operations. More problematic is the situation with four (4) medieval bridges, numbers 005, 006, 007 and 008, which will carry the aftereffects of direct impact (Table 42). In this case, more probably, special safeguard measures and construction regime are required, including redesign of the road and change of the configuration of their outline. As for the rest five (5) units, which are not being directly affected (numbers 002, 003, 014, 016 and 019, Table 1), two (2) of which are churches, besides of the rules established for the sites with indirect impact, additional road-construction mitigation measures are also required, like in the case of the bridges. Those tasks will be discussed in detail during the next, construction step of the implementation of the project. As a summary we can stress, that serious barriers for the construction of the Kajaran-Agarak highway by means of archaeological and historical-cultural resources do not exist.

It is also necessary to add, that during the whole duration of the project the so-called “chance find procedure” must be required for the whole area involved under the construction activities, which means that if during the excavations and soil removal activities any type of historical-cultural resources will be discovered, the works will be stopped immediately, till corresponding solutions for saving their value or other safeguard measures will be suggested.



During the fieldwork activities areas, which are planned to use under dumping the construction waste and debris were also studied in detail. These lack any kind of cultural-historical barriers and can be utilized under the above-mentioned purpose. Meanwhile, taking into consideration the construction of the tunnel, it is becoming obvious that the targeted areas will not be enough for accumulation of the whole volume of the waste and debris. There will be a need to select new dumping areas, which will require new archaeological fieldwork investigations.

Finally, the provided project lacks the distribution of infrastructures, which, while being implemented, will create unexpected negative risks for the cultural resources. This needs future attention and solutions.

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31.08.2021

Table 42: List of documented monuments, which have historical and cultural value

Site type	Unit number	X	Y	Z	Community	Code in the state list
Necropolis	001	604397,66	4335594,95	1529	Lernadzor	8.38.8.
Archaeological complex	002	604171,22	4335110,31	1514	Lernadzor	8.38.1.
Old Lernadzor village remains	003	604113,11	4334917,95	1551	Lernadzor	8.38.5., 8.38.5.1. and 8.35.5.2.
Structures	004	601769,87	4326458,69	1884	Tashtun	Newly discovered
Bridge	005	602808,45	4325072,04	1750	Tashtun	8.100.5.
Bridge 1	006	603618,38	4323770,55	1649	Lichk	Newly discovered
Bridge 2	007	604597,95	4318702,85	1285	Lichk	Newly discovered
Bridge	008	604603,17	4318230,09	1260	Vardanidzor	Newly discovered
Khachkar-1	009	604485,94	4315820,37	1140	Vardanidzor	Newly discovered
Structures 1	010	604569,79	4315673,27	1132	Vardanidzor	Newly discovered
Pushkag Medieval village remains	011	604611,74	4315420,33	1120	Vardanidzor	8.92.4. and 8.92.4.1.
Khachkar-2	012	605234,24	4314652,99	1074	Vardanidzor	Newly discovered
Horticultural landscape	013	605276,78	4314555,52	1092	Vardanidzor	Newly discovered
Structures 2	014	605213,6	4313536,53	1036	Vardanidzor	Newly discovered
Structures 3	015	605135,88	4313088,28	1021	Vardanidzor	Newly discovered
Cemetery	016	605605,46	4311065,89	909	Lehvaz	8.37.1.
Water Mill	017	605620,85	4310640,61	860	Lehvaz	8.37.5.
Horticultural landscape	018	605833,98	4308546,52	794	Gudemnis	Newly discovered
Meghri Pokr Tagh complex	019	607726,95	4305976,82	670	Meghri	8.5.2.1.-8.5.2.20.



Sites being directly affected are given in red color

Legend

	Cemetery		Necropolis
	Church		Structures
	Khachkar		Bridge
	Settlement		Water Mill
			Horticultural landscape

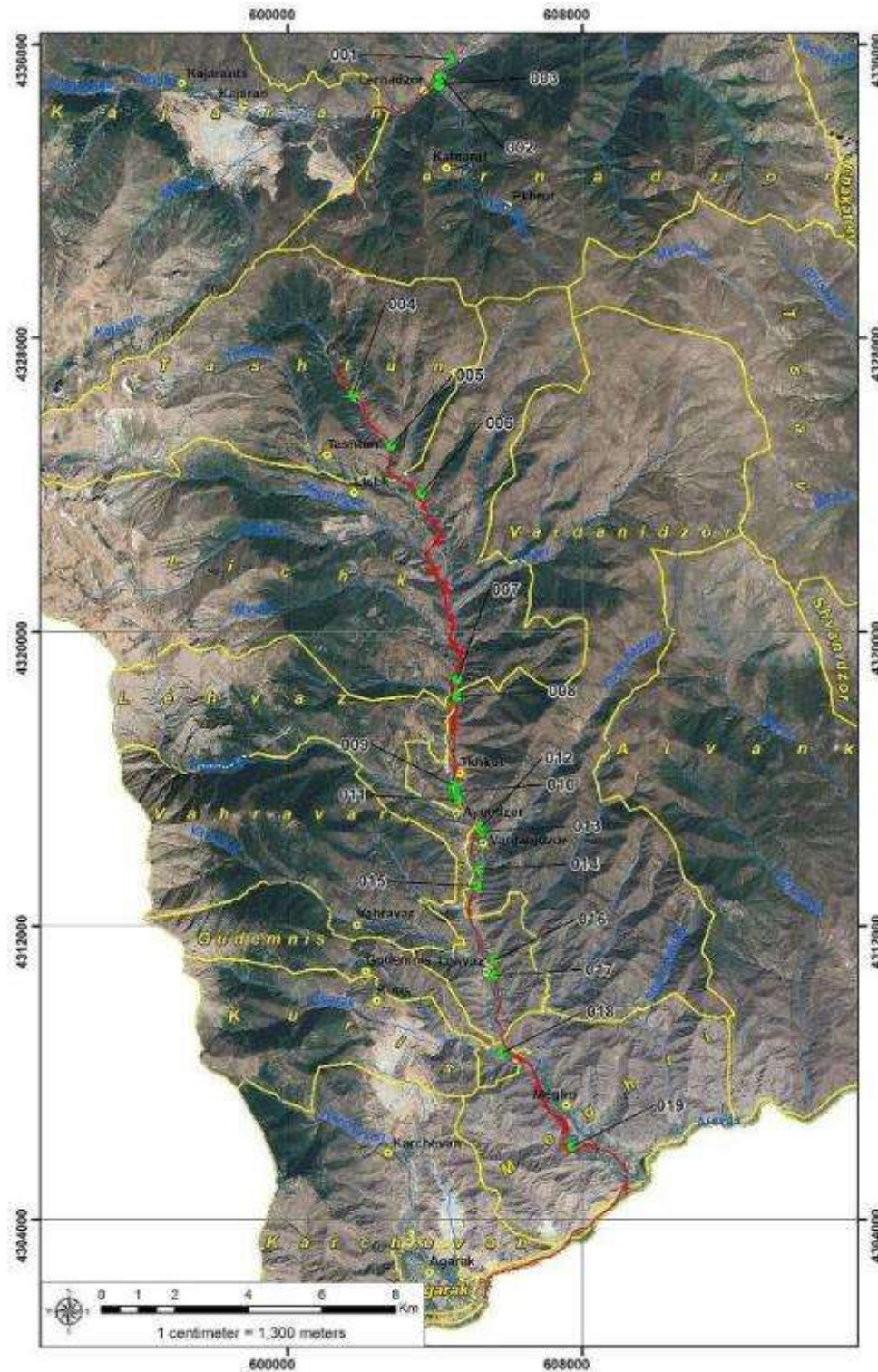


Figure 76: 42.300 km long alignment of the Kajaran-Agarak highway section
(Tranche 4, Lot 1 and Lot 2)

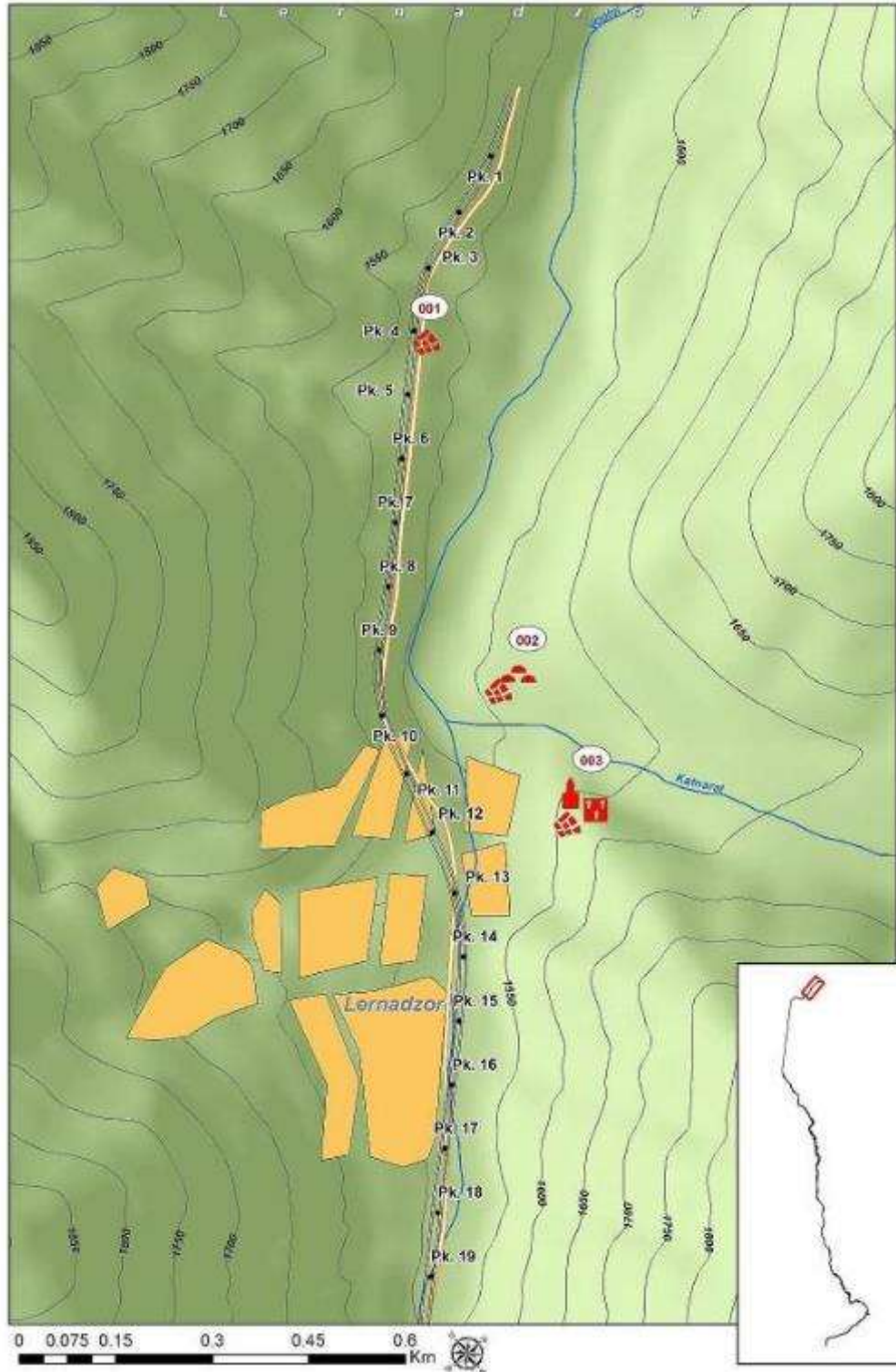


Figure 77: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor village,
Pk 0.0 – Pk 1.9

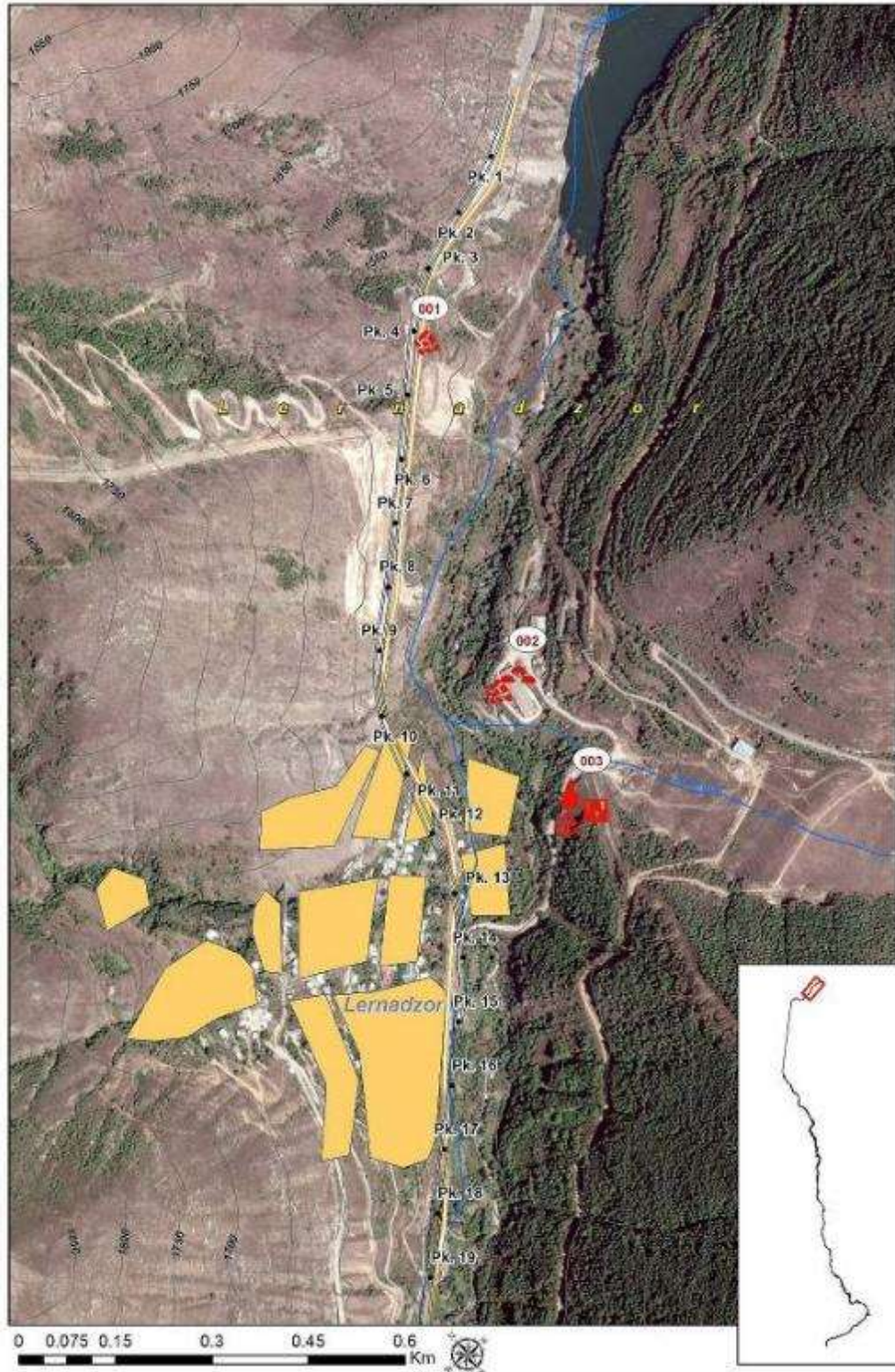


Figure 78: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor village, Pk 0.0 – Pk 1.9

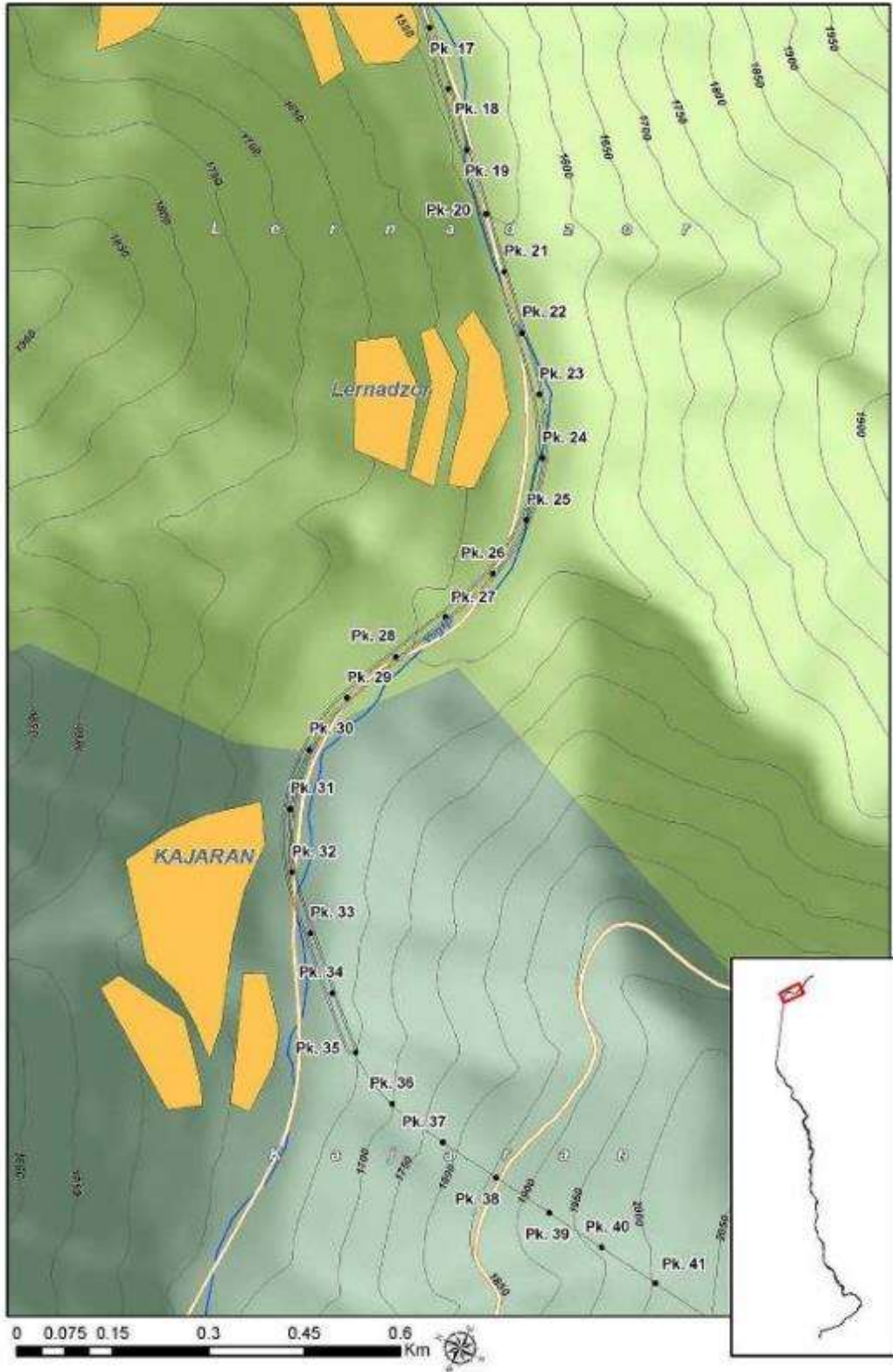


Figure 79: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor village and Kajaran city, Pk 1.9 – Pk 4.1

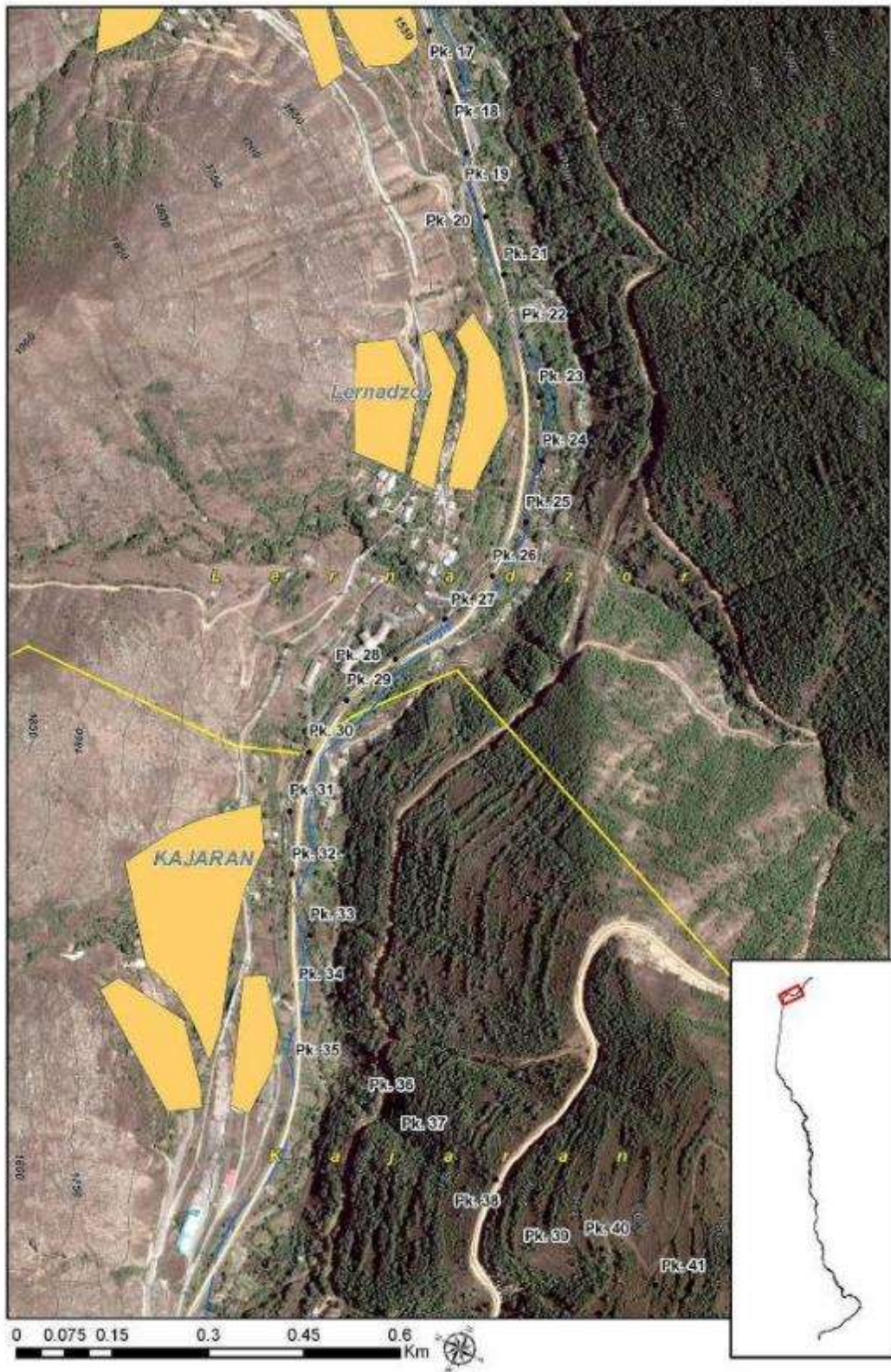


Figure 80: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor village and Kajaran city, Pk 1.9 – Pk 4.1

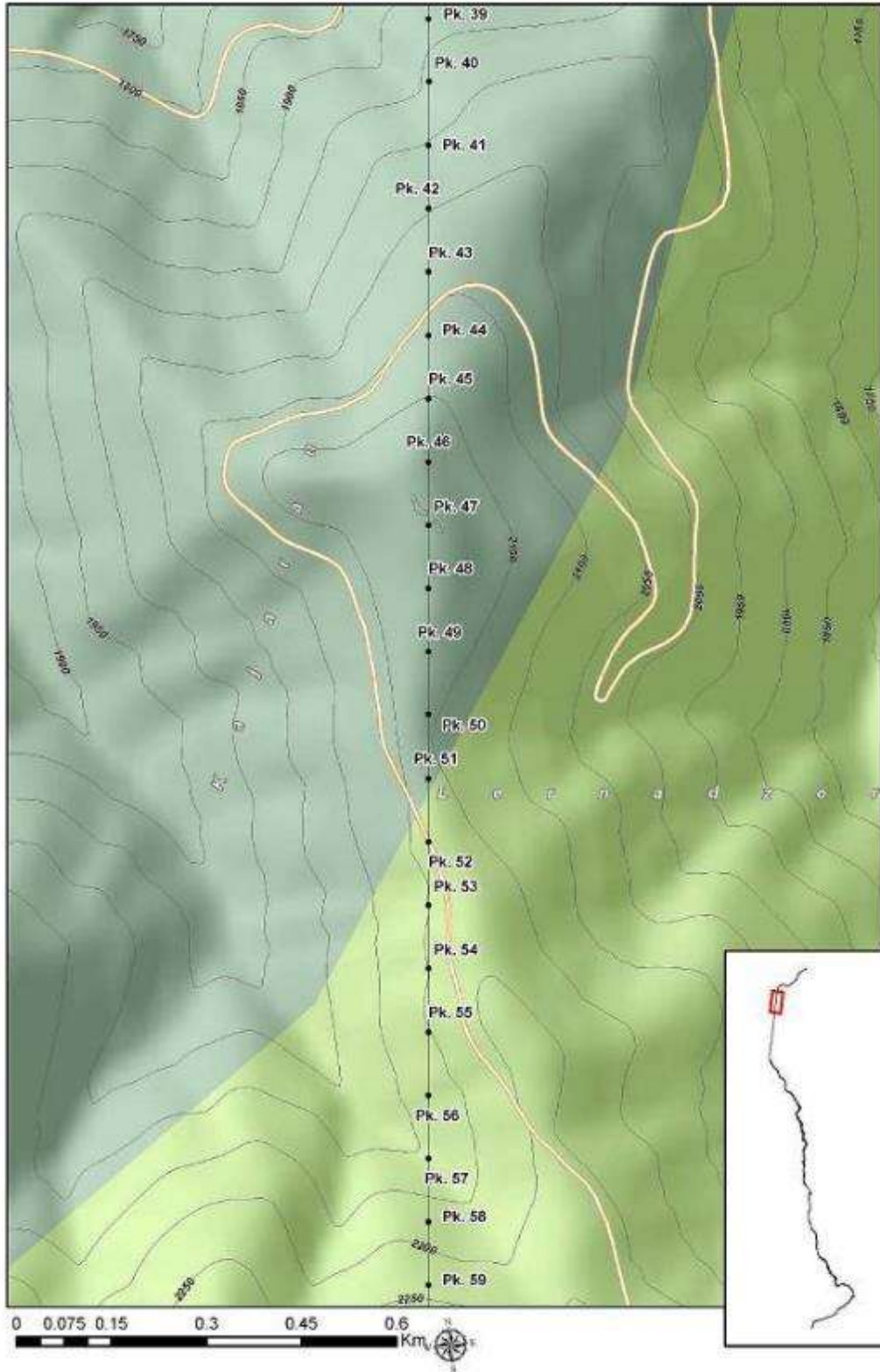


Figure 81: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Kajaran city and Lernadzor village, Pk 4.1 – Pk 5.9

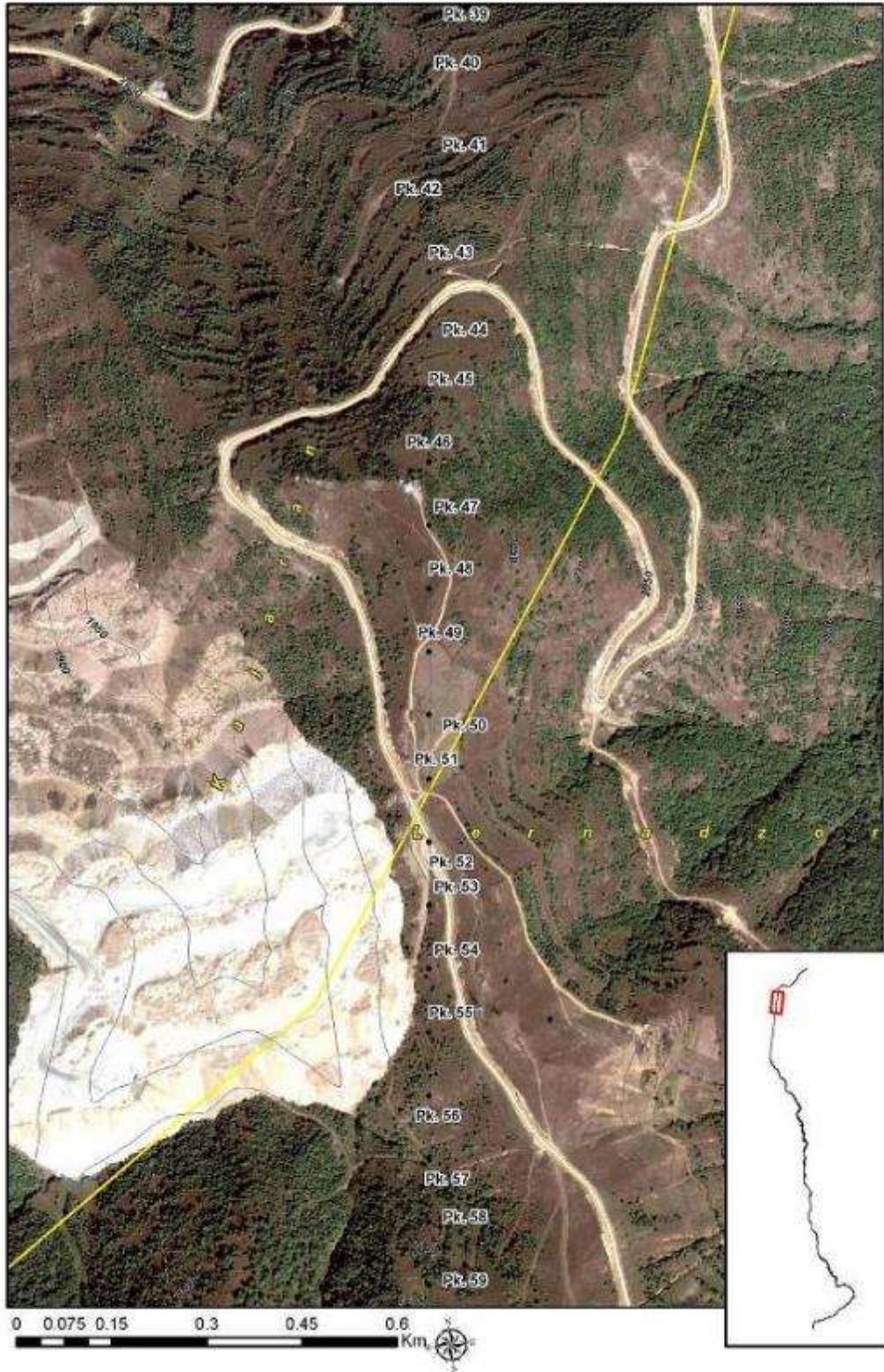


Figure 82: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Kajaran city and Lernadzor village, Pk 4.1 – Pk 5.9

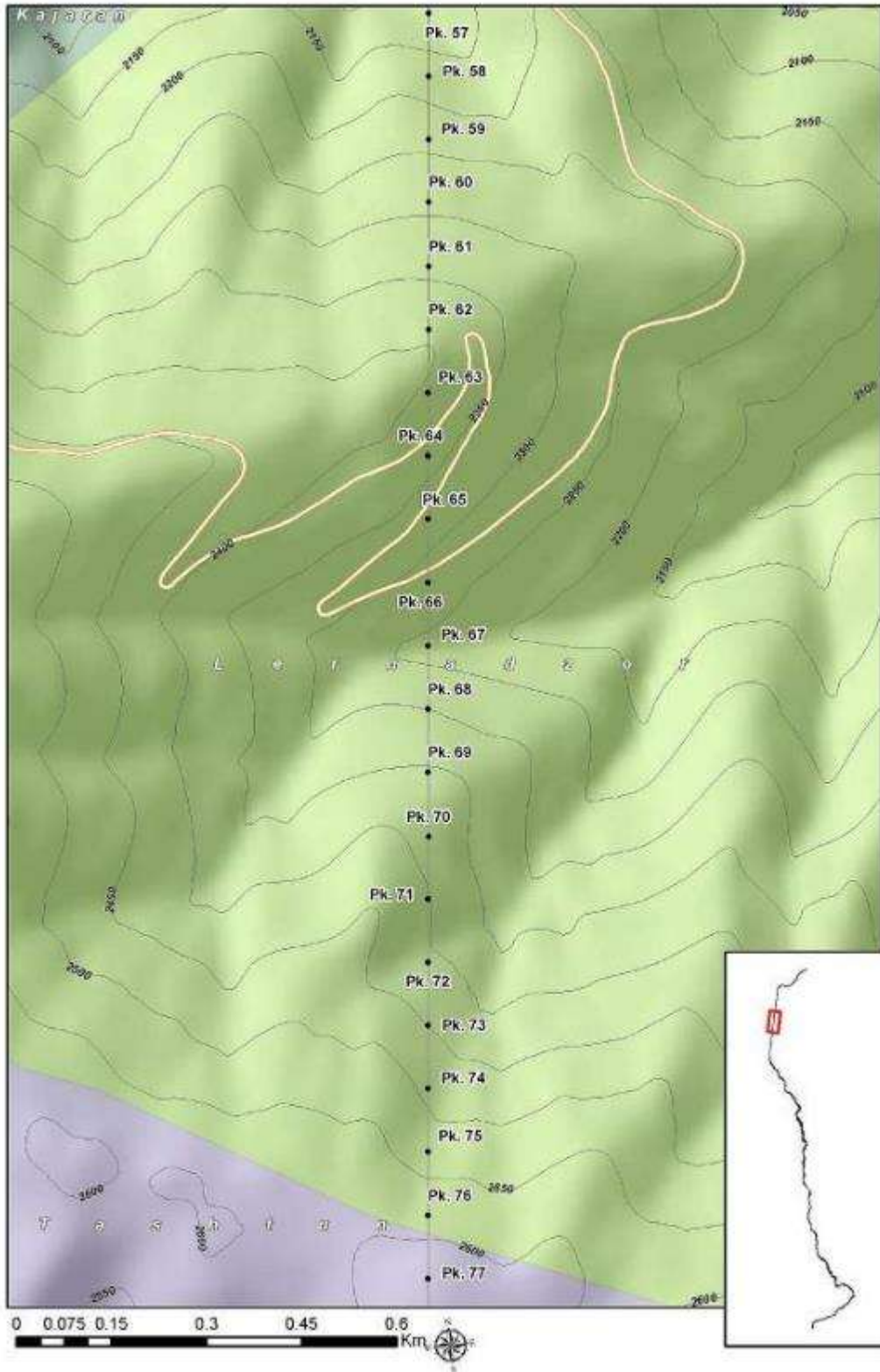


Figure 83: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor and Tashtun villages, Pk 5.9 – Pk 7.7

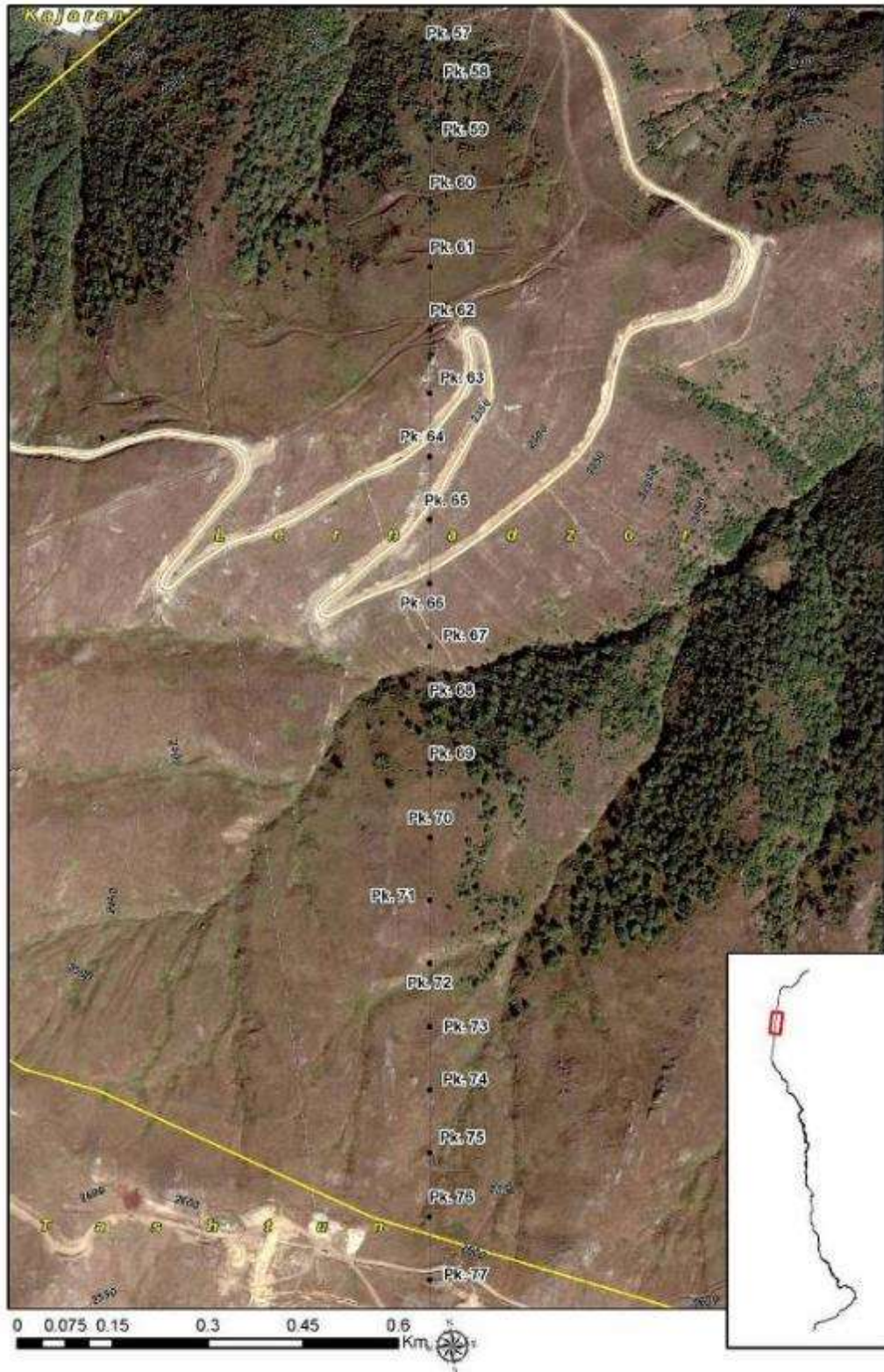


Figure 84: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lernadzor and Tashtun villages, Pk 5.9 – Pk 7.7

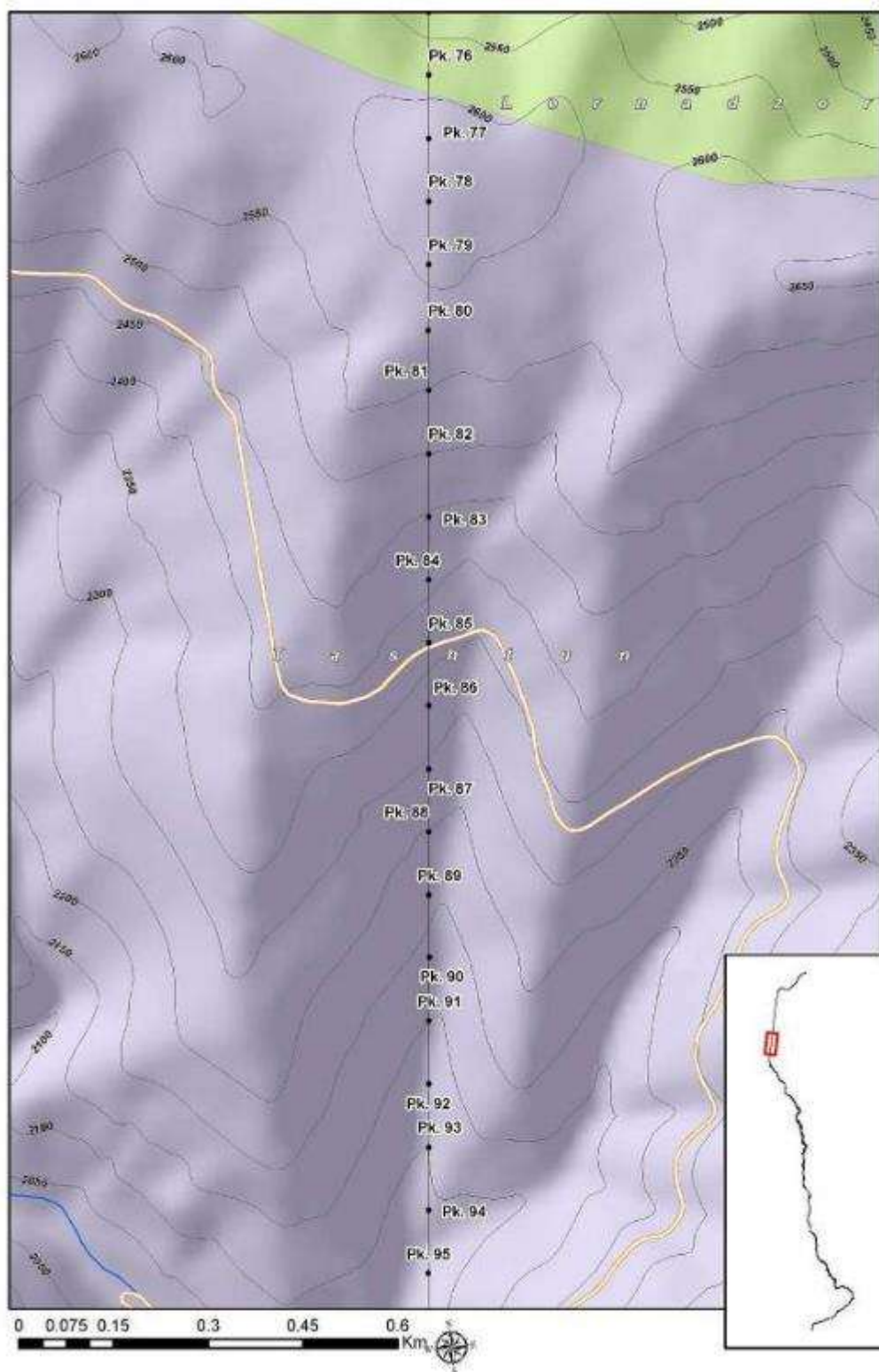


Figure 85: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 7.7 – Pk 9.5



Figure 86: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 7.7 – Pk 9.5

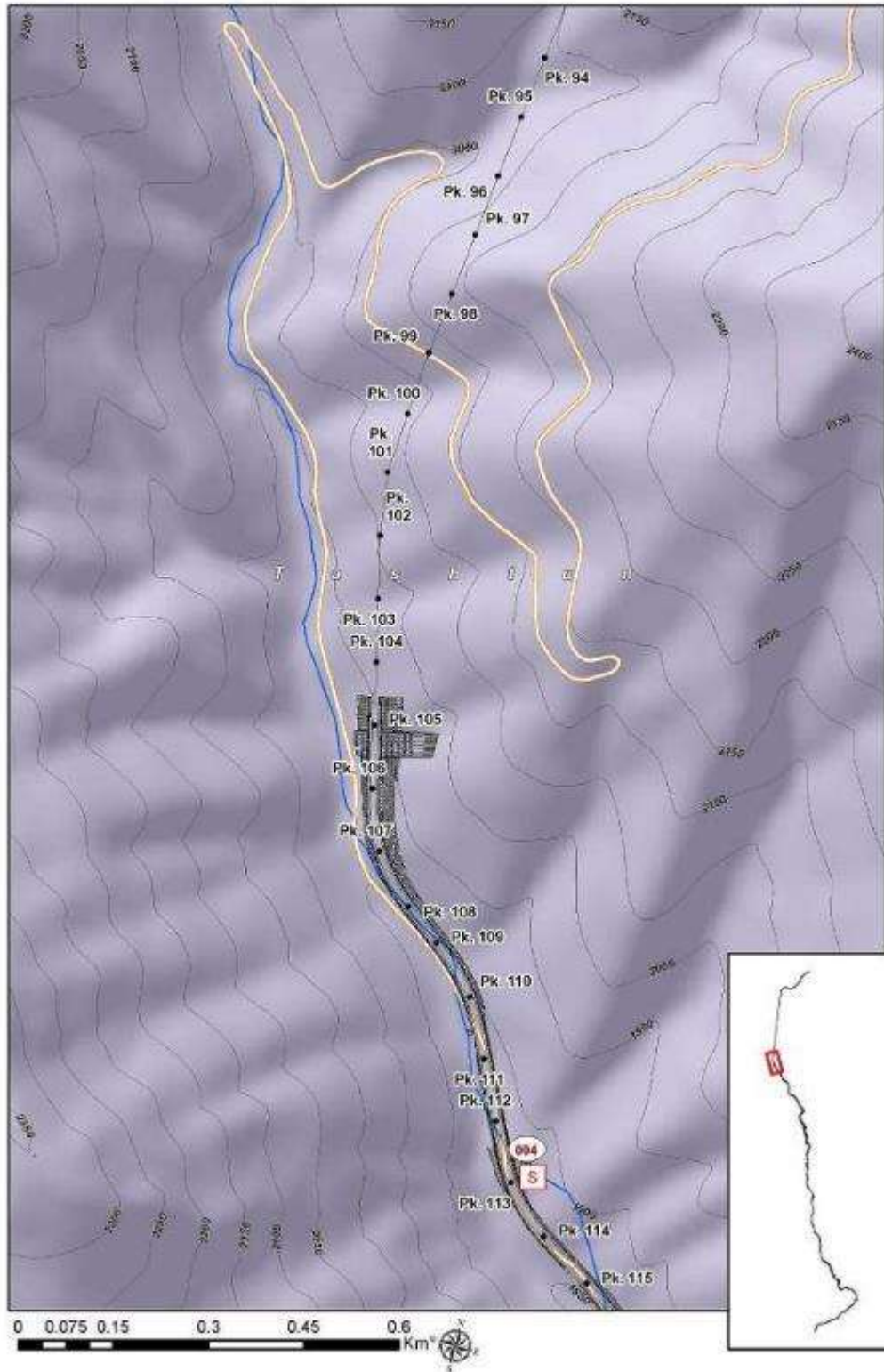


Figure 87: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 9.5 – Pk 11.5



Figure 88: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 9.5 – Pk 11.5

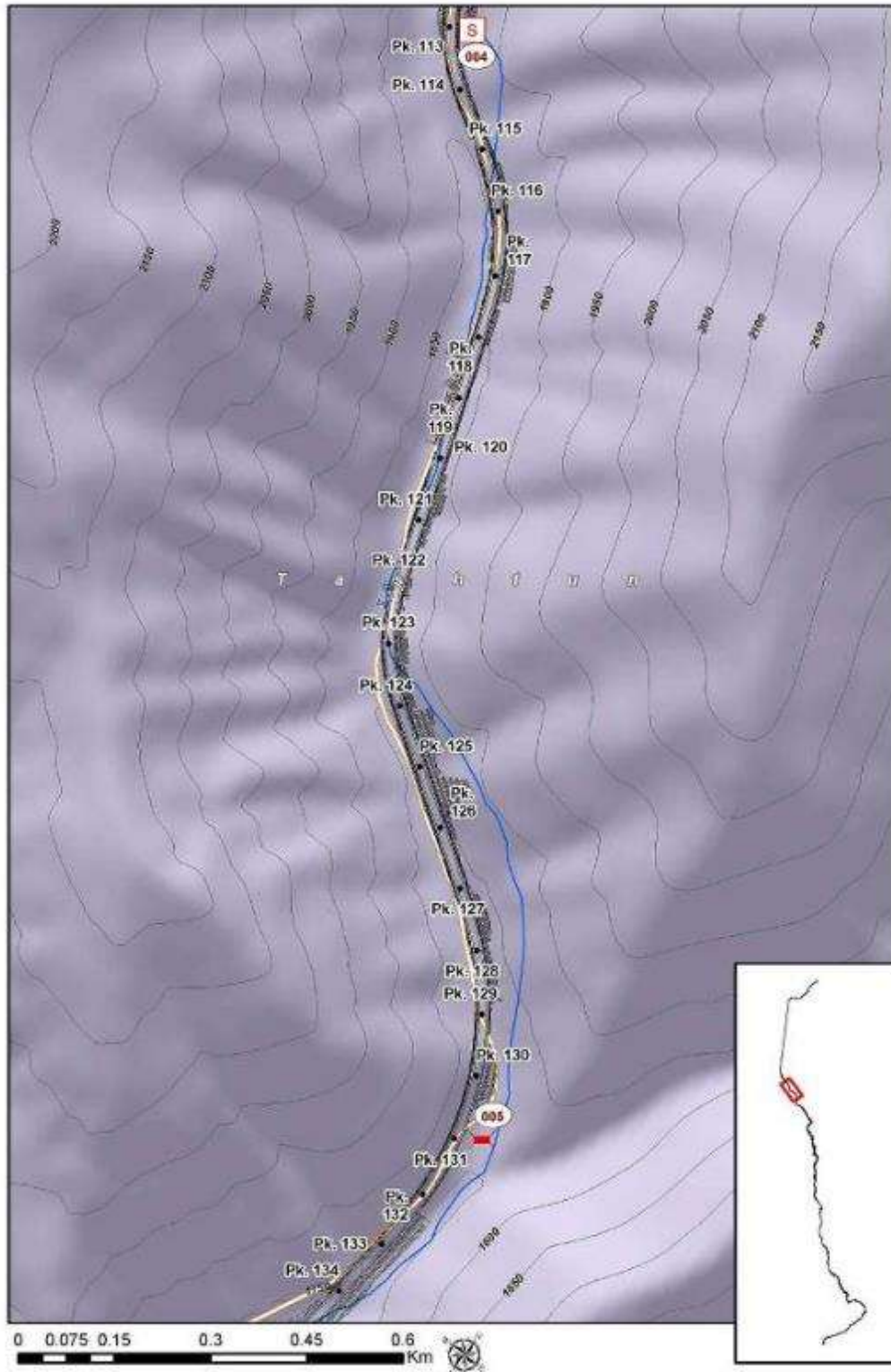


Figure 89: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 11.5 – Pk 13.4



Figure 90: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun village, Pk 11.5 – Pk 13.4

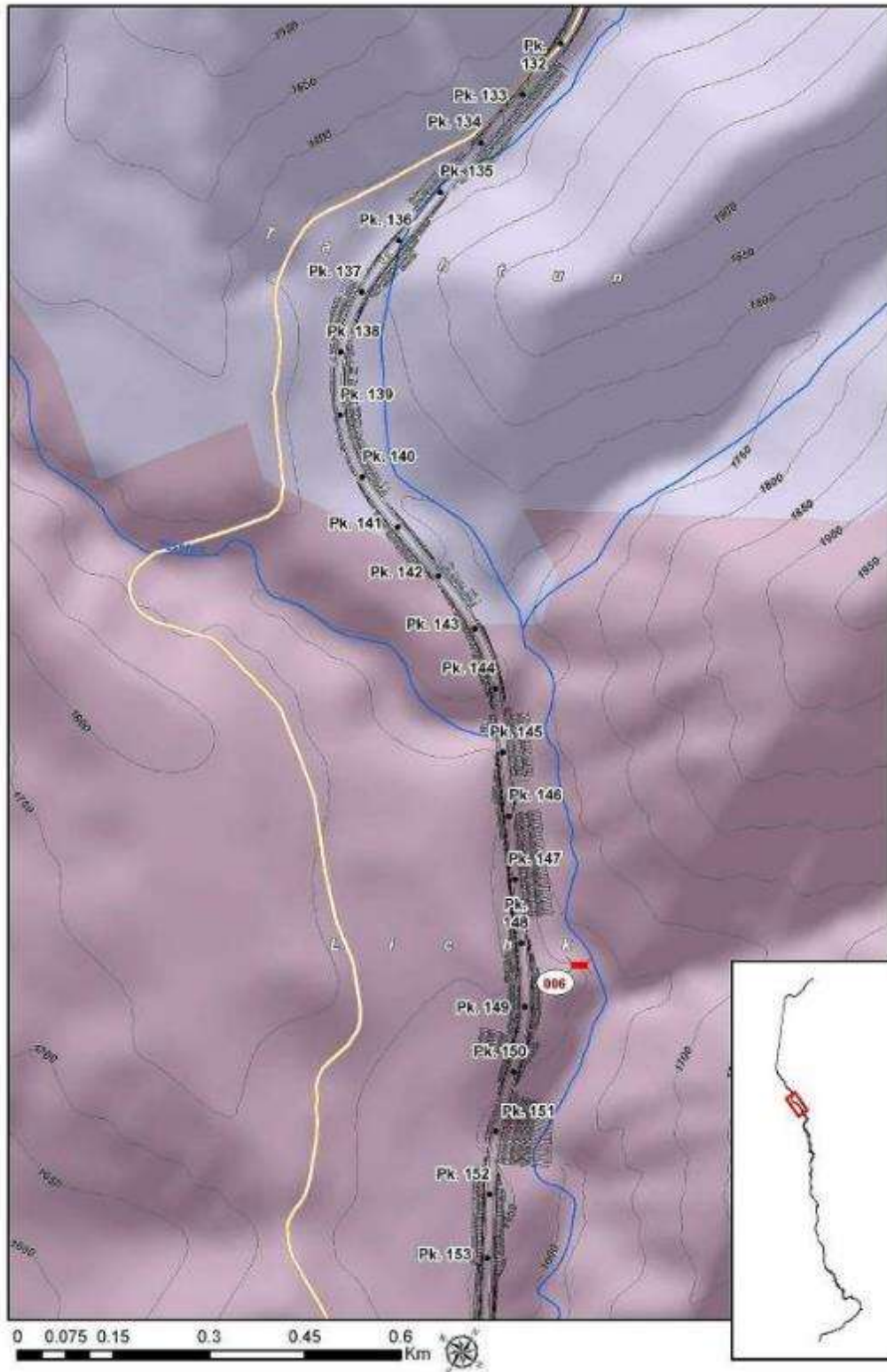


Figure 91: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun and Lichk villages, Pk 13.4 – Pk 15.4



Figure 92: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Tashtun and Lichk villages, Pk 13.4 – Pk 15.4

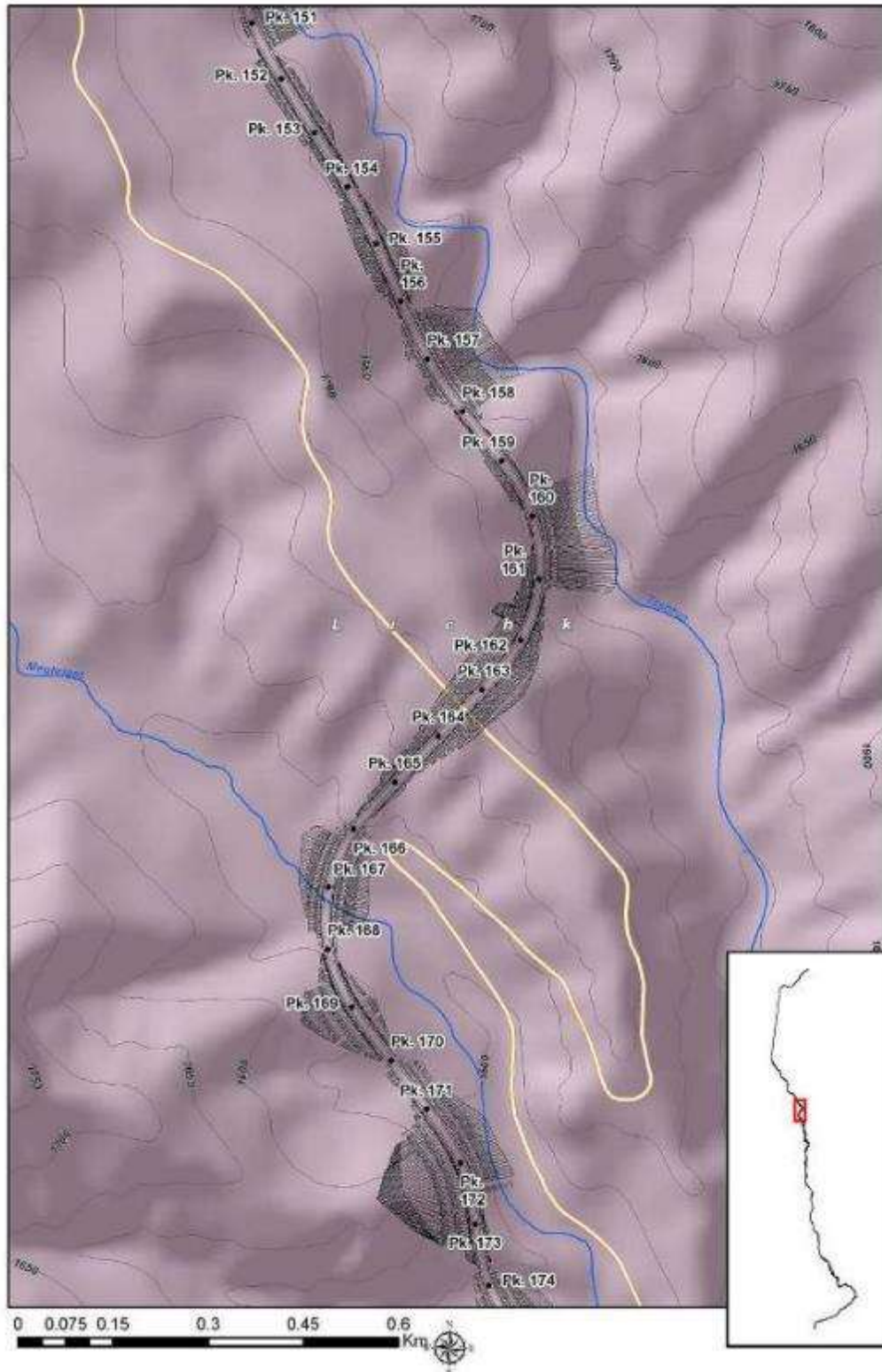


Figure 93: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk village, Pk 15.4 – Pk 17.4

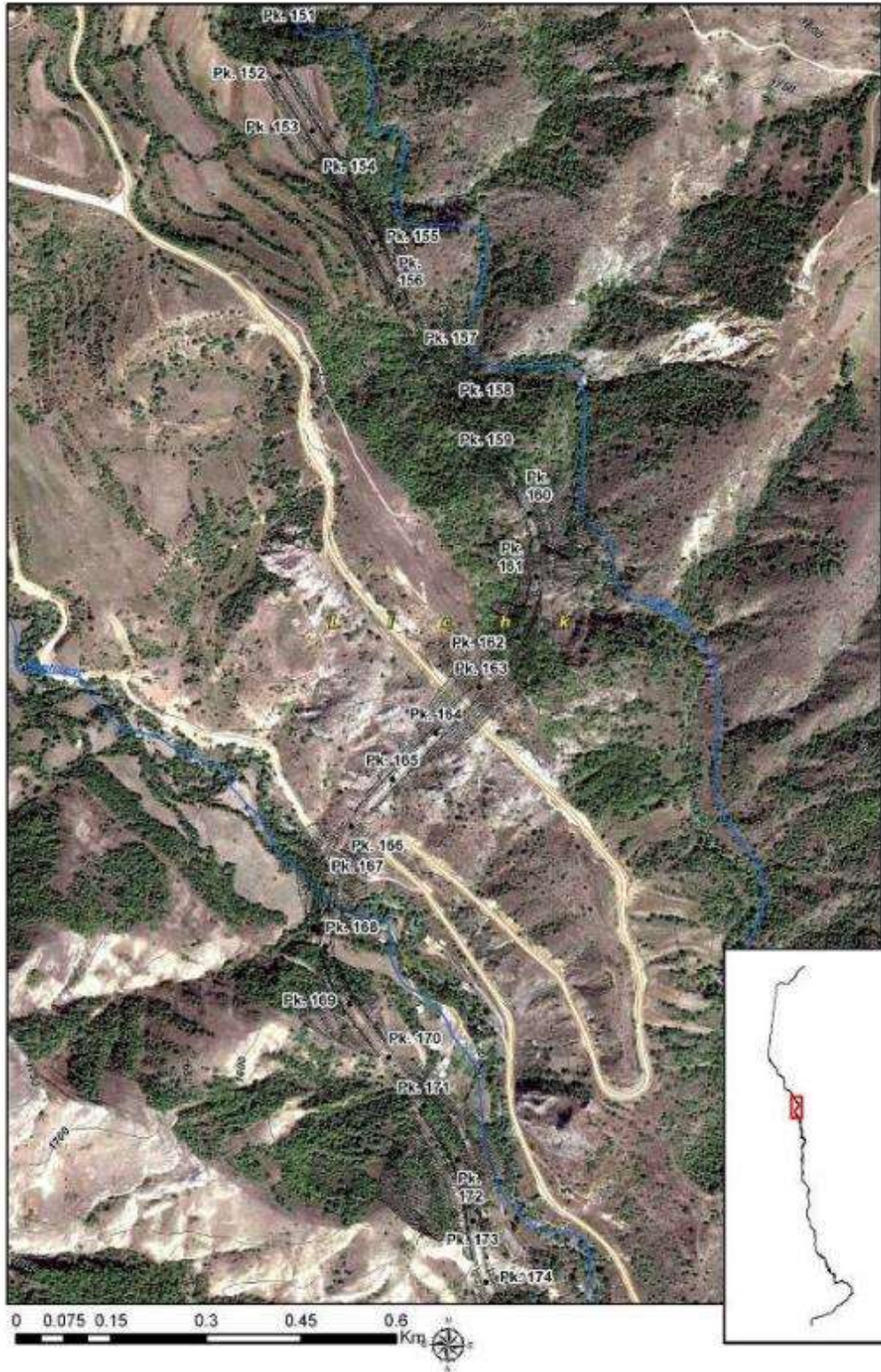


Figure 94: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk village, Pk 15.4 – Pk 17.4

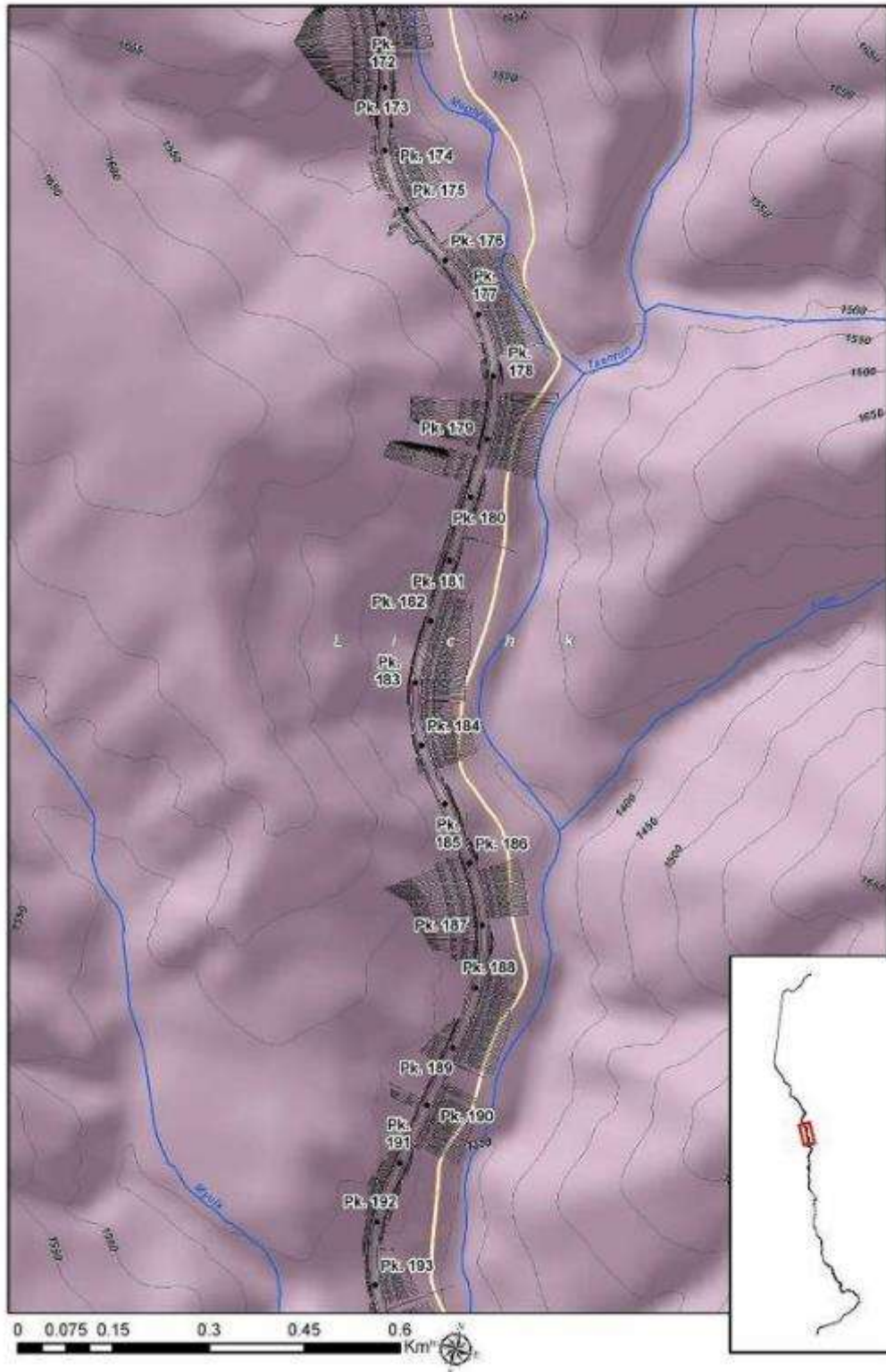


Figure 95: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk village, Pk 17.4 – Pk 19.3



Figure 96: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk village, Pk 17.4 – Pk 19.3



Figure 97: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk, Vardanidzor and Lehvaz villages, Pk 19.3 – Pk 21.2



Figure 98: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Lichk, Vardanidzor and Lehvaz villages, Pk 19.3 – Pk 21.2

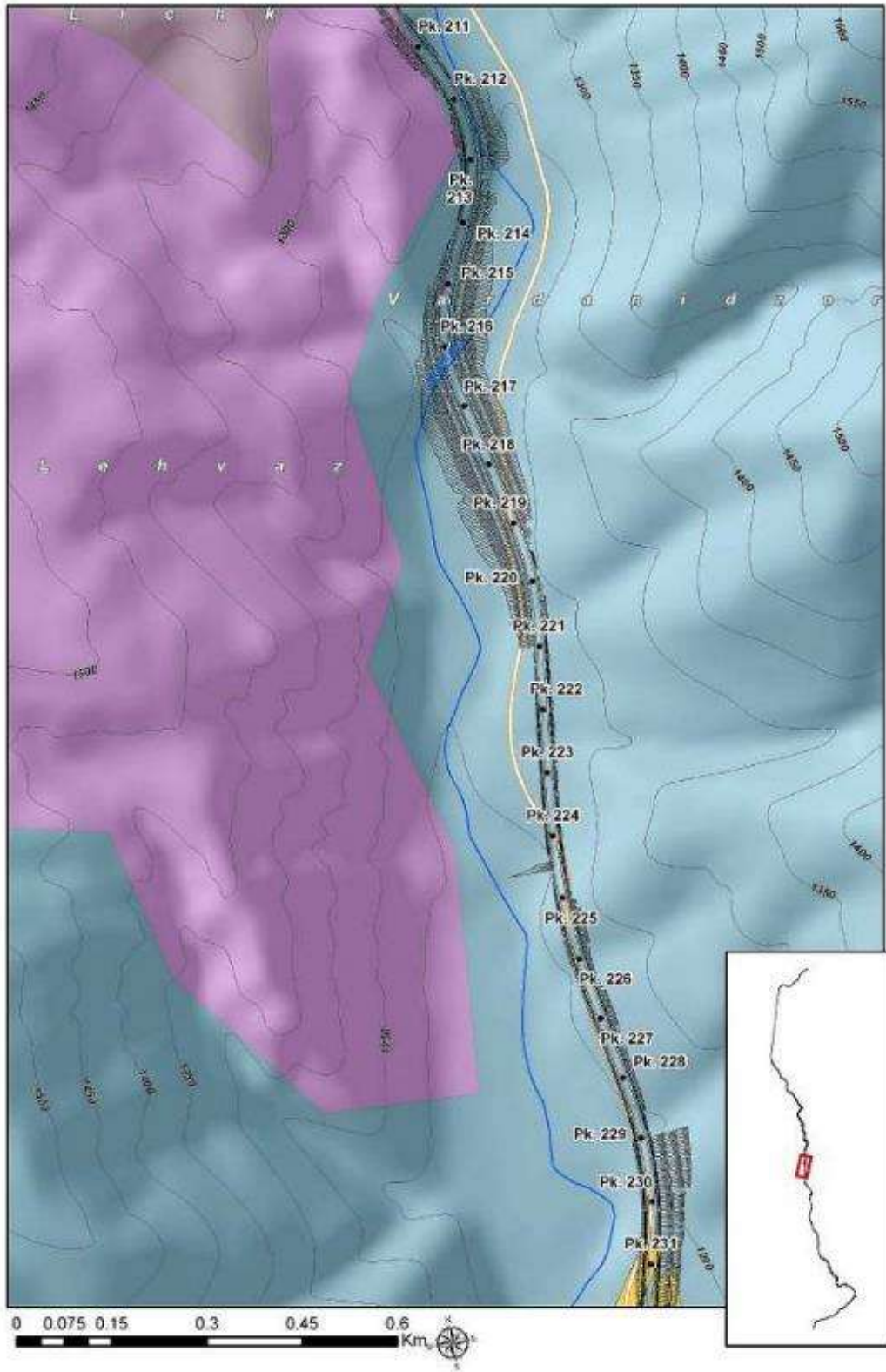


Figure 99: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Vardanidzor and Lehvaz villages, Pk 21.2 – Pk 23.1

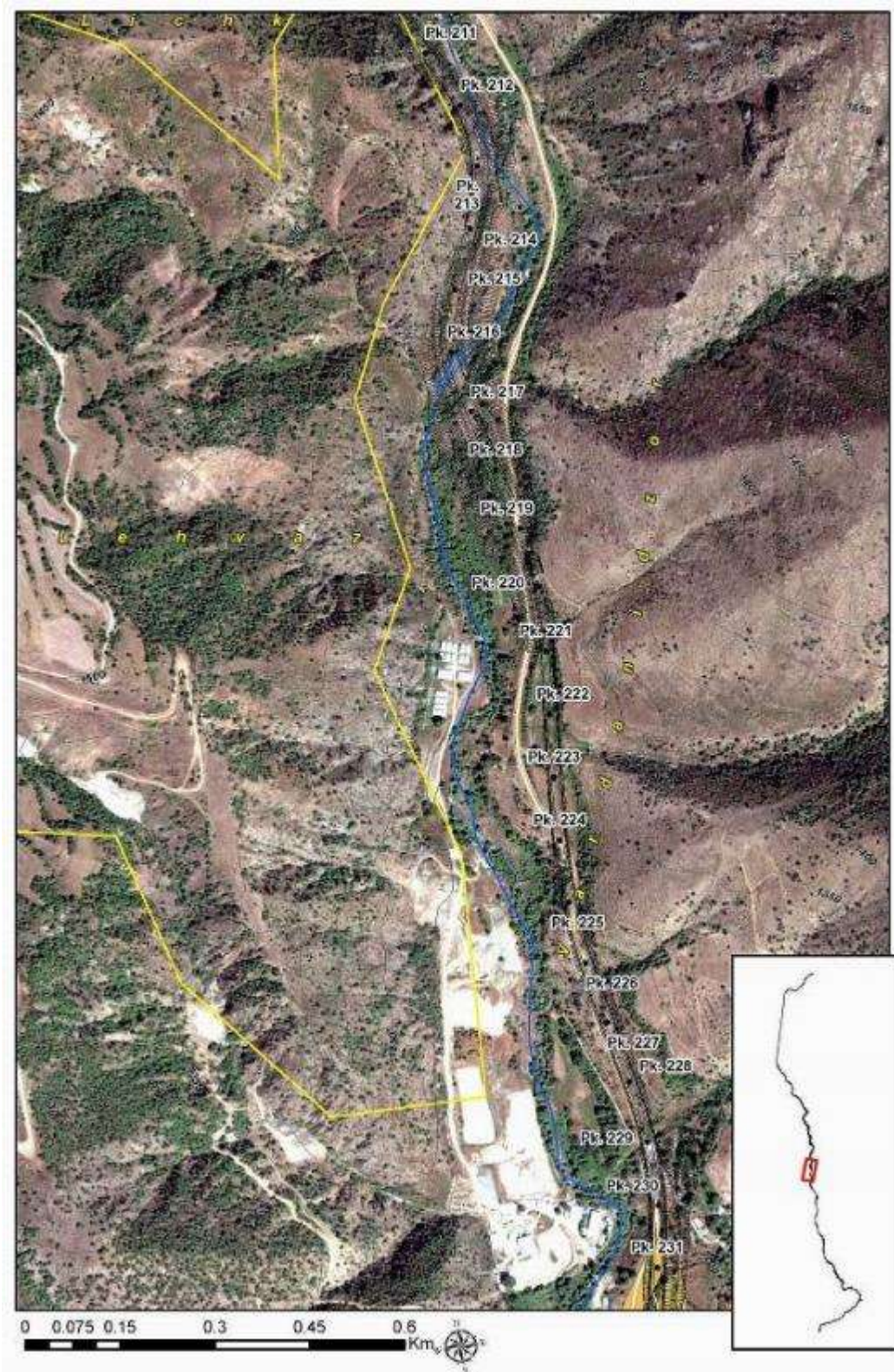


Figure 100: Kajaran-Agarak highway alignment (Tranche 4, Lot 2), Vardanidzor and Lehvaz villages, Pk 21.2 – Pk 23.1



Figure 101: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Vardanidzor and Lehvaz villages, Pk 23.1 – Pk 24.9

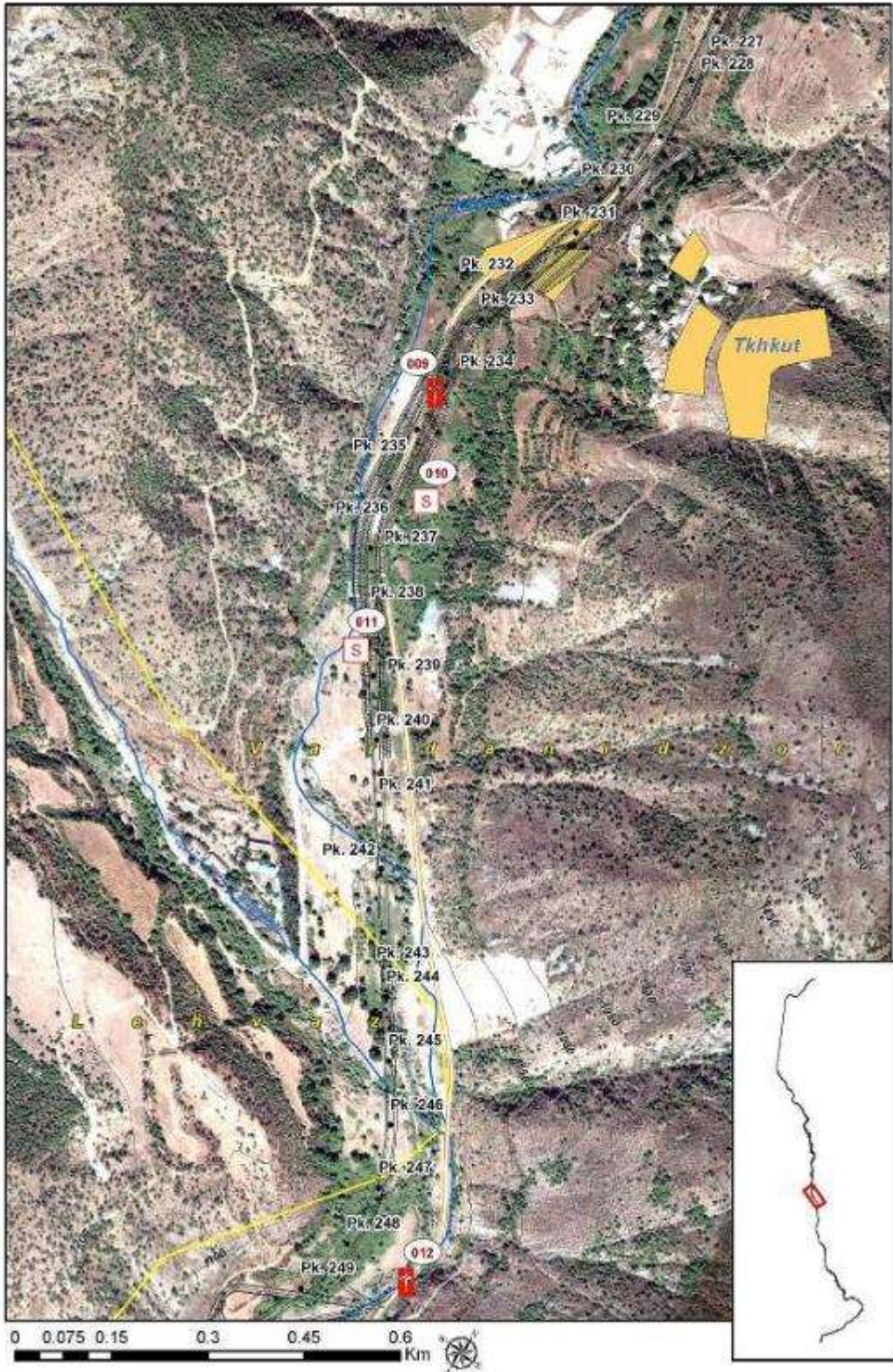


Figure 102: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Vardanidzor and Lehvaz villages, Pk 23.1 – Pk 24.9

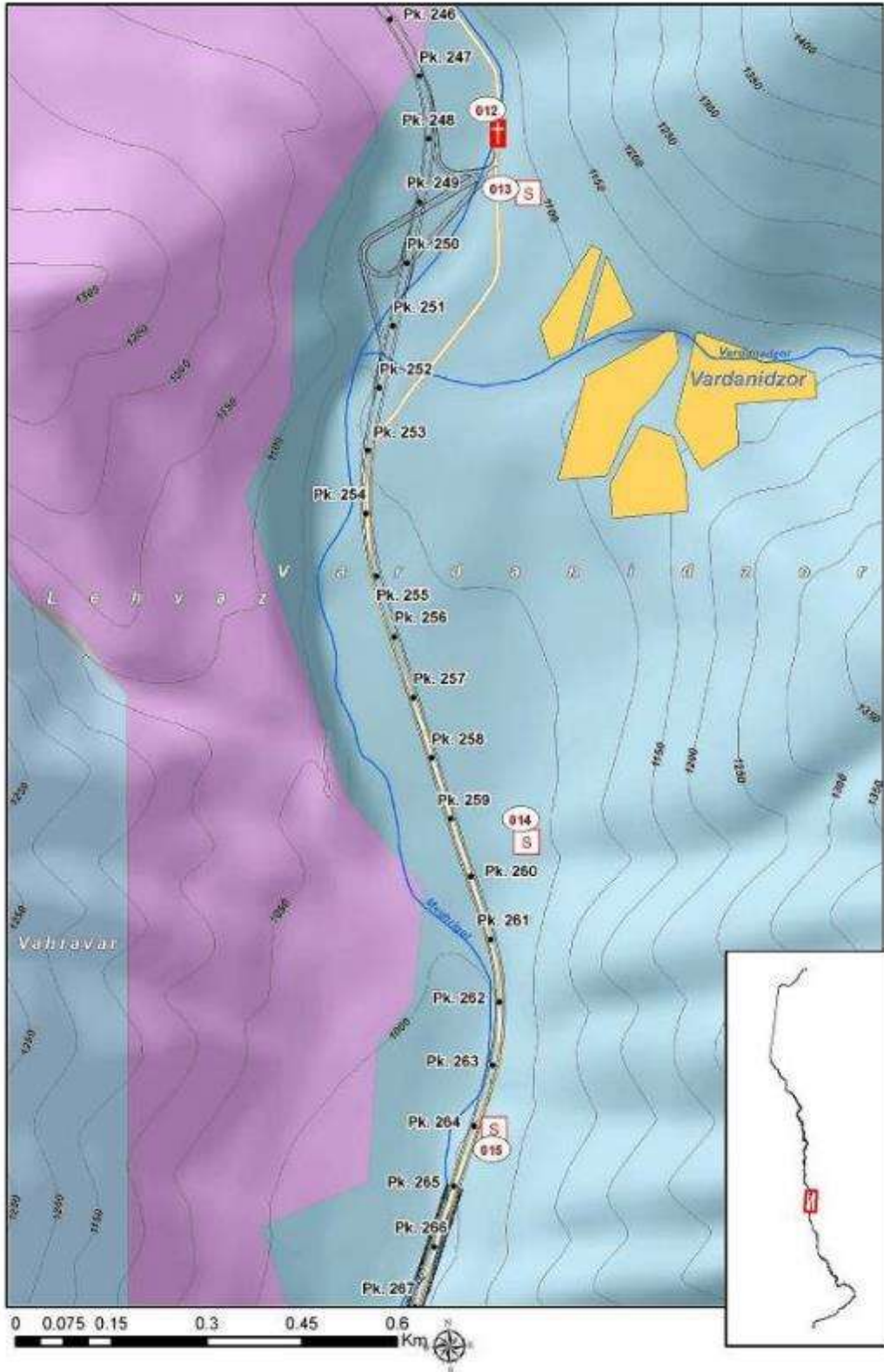


Figure 103: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz and Vardanidzor villages, Pk 24.9 – Pk 26.5

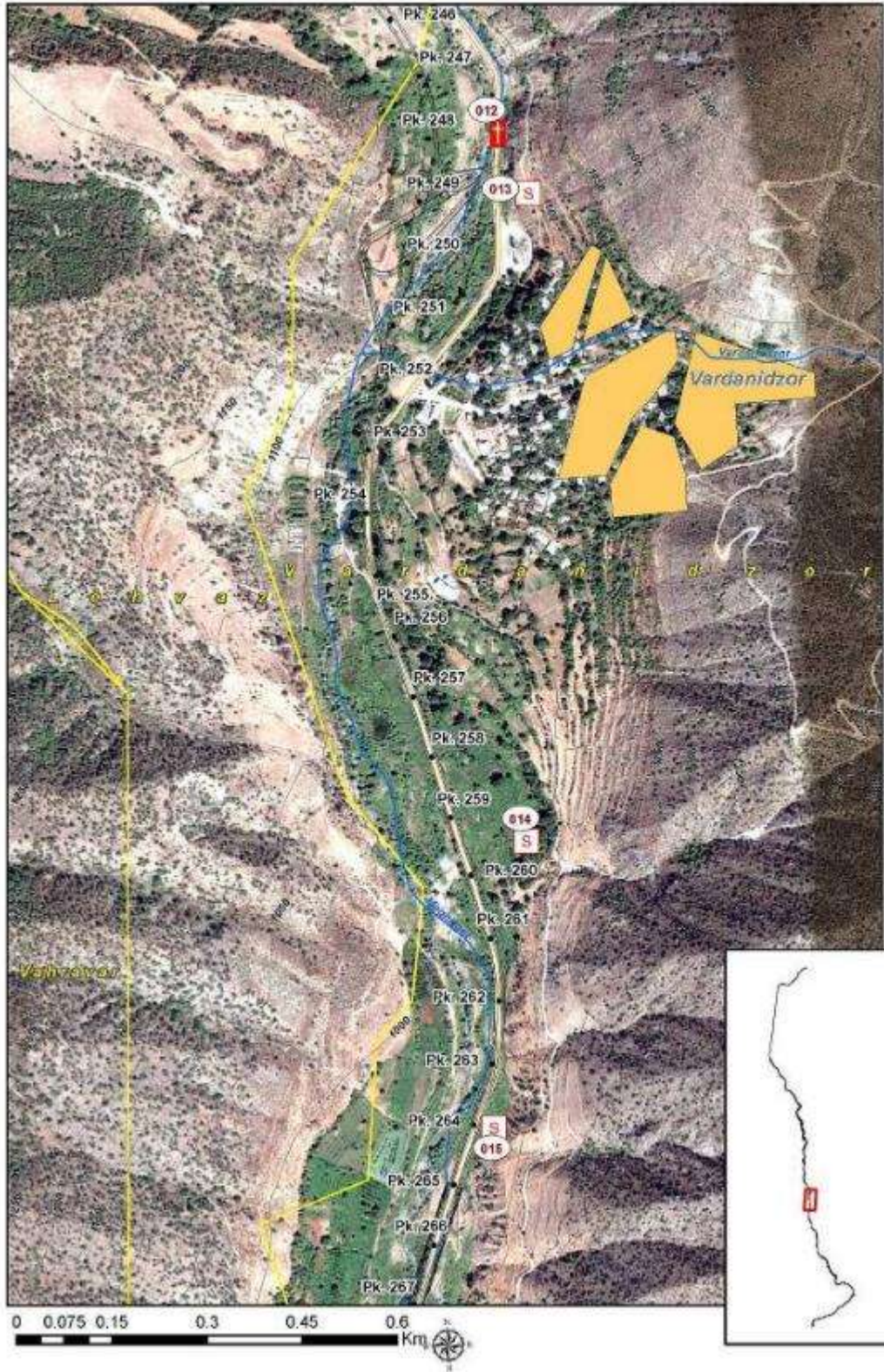


Figure 104: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz and Vardanidzor villages, Pk 24.9 – Pk 26.5

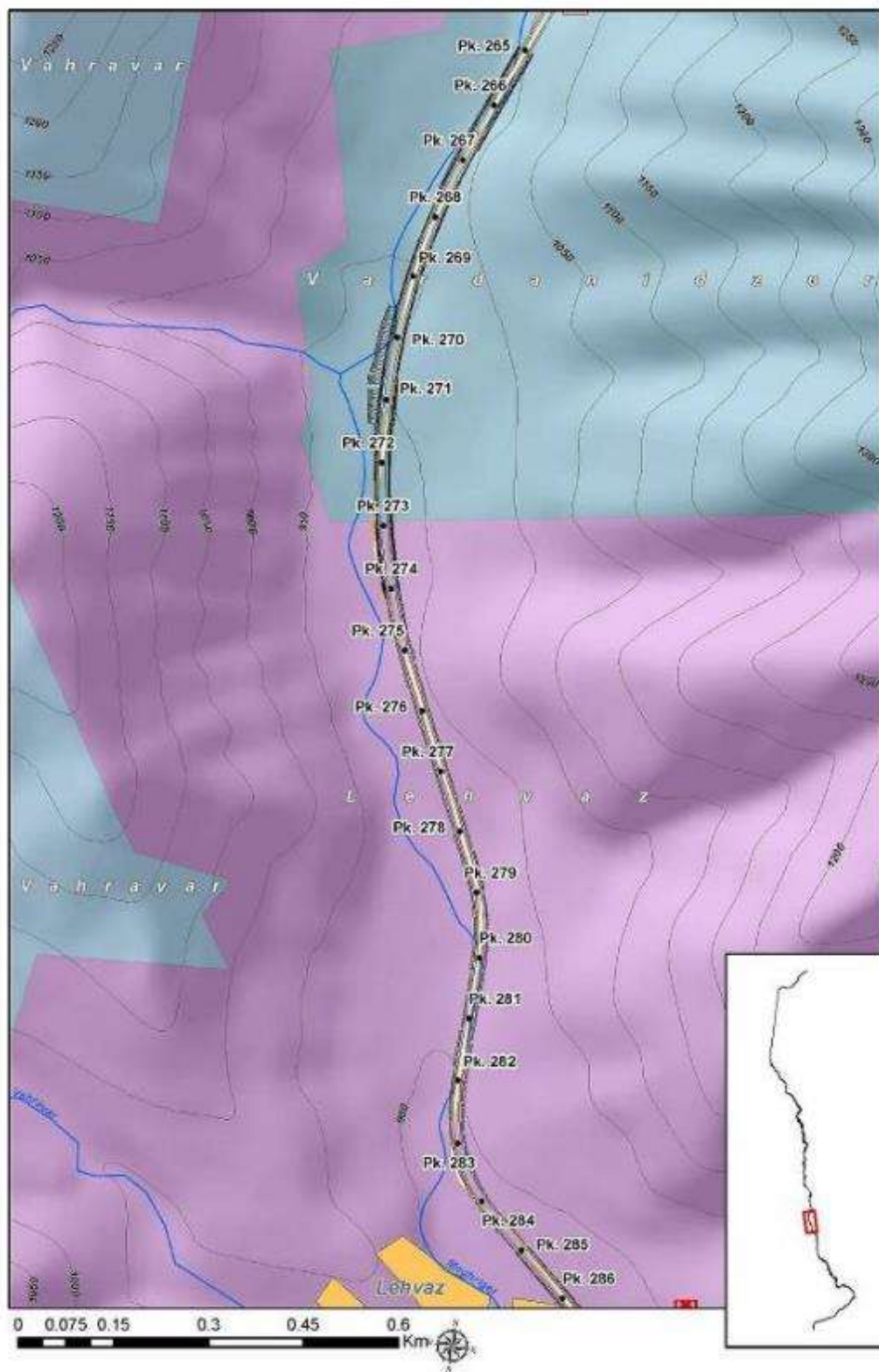


Figure 105: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Vardandzor and Lehvaz villages, Pk 26.5 – Pk 28.6

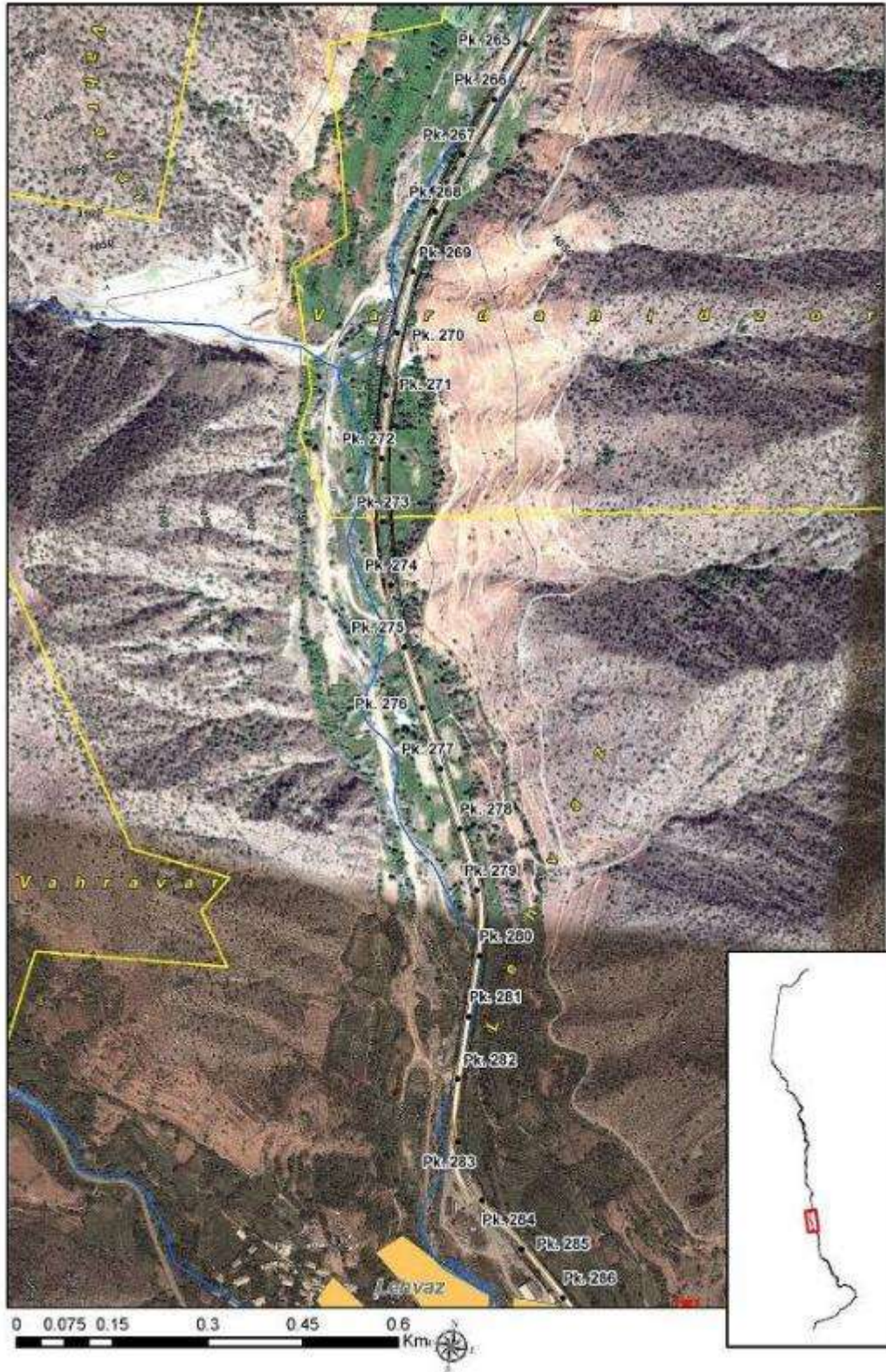


Figure 106: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Vardanidzor and Lehvaz villages, Pk 26.5 – Pk 28.6

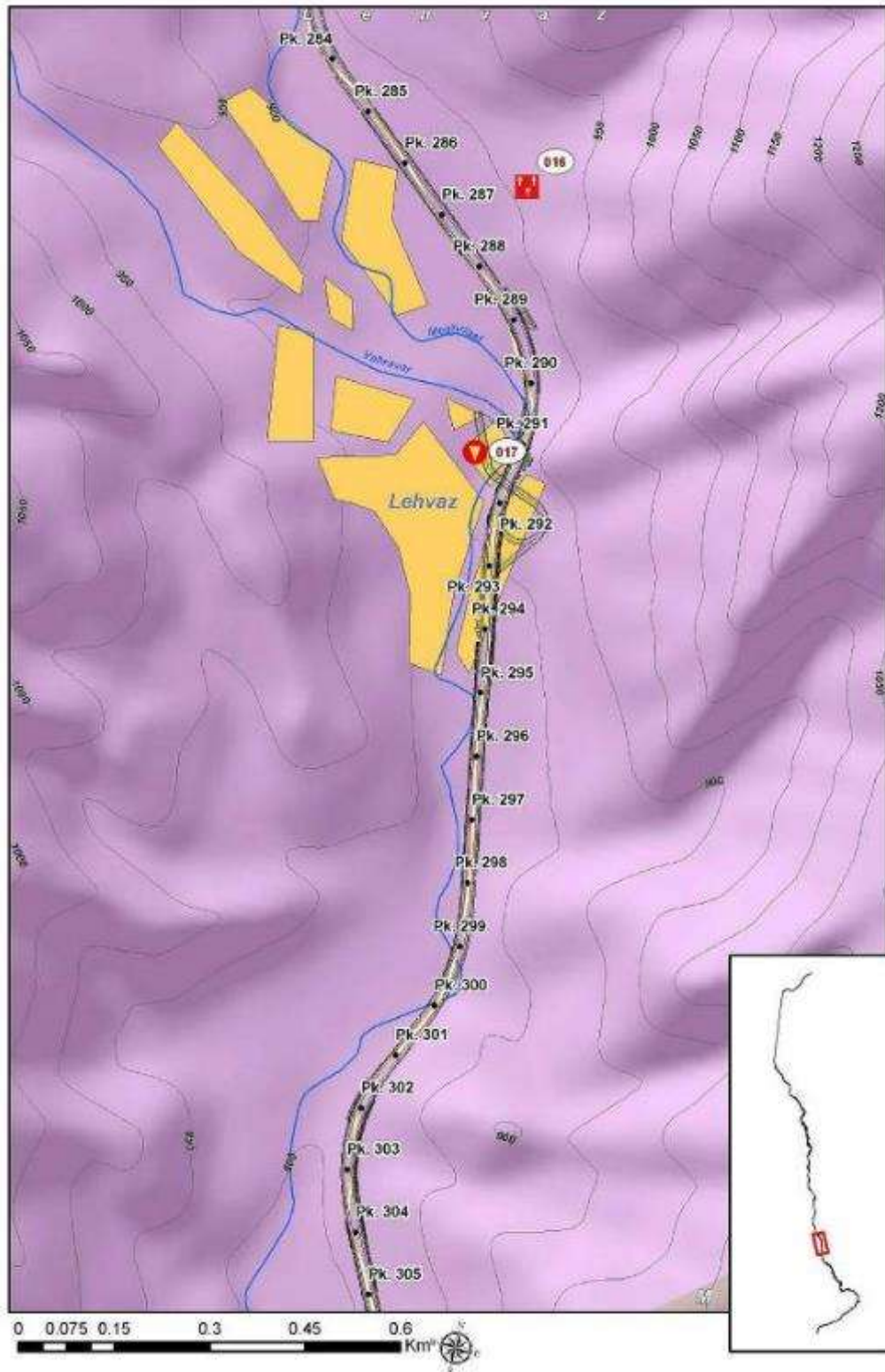


Figure 107: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz village, Pk 28.6 – Pk 30.5

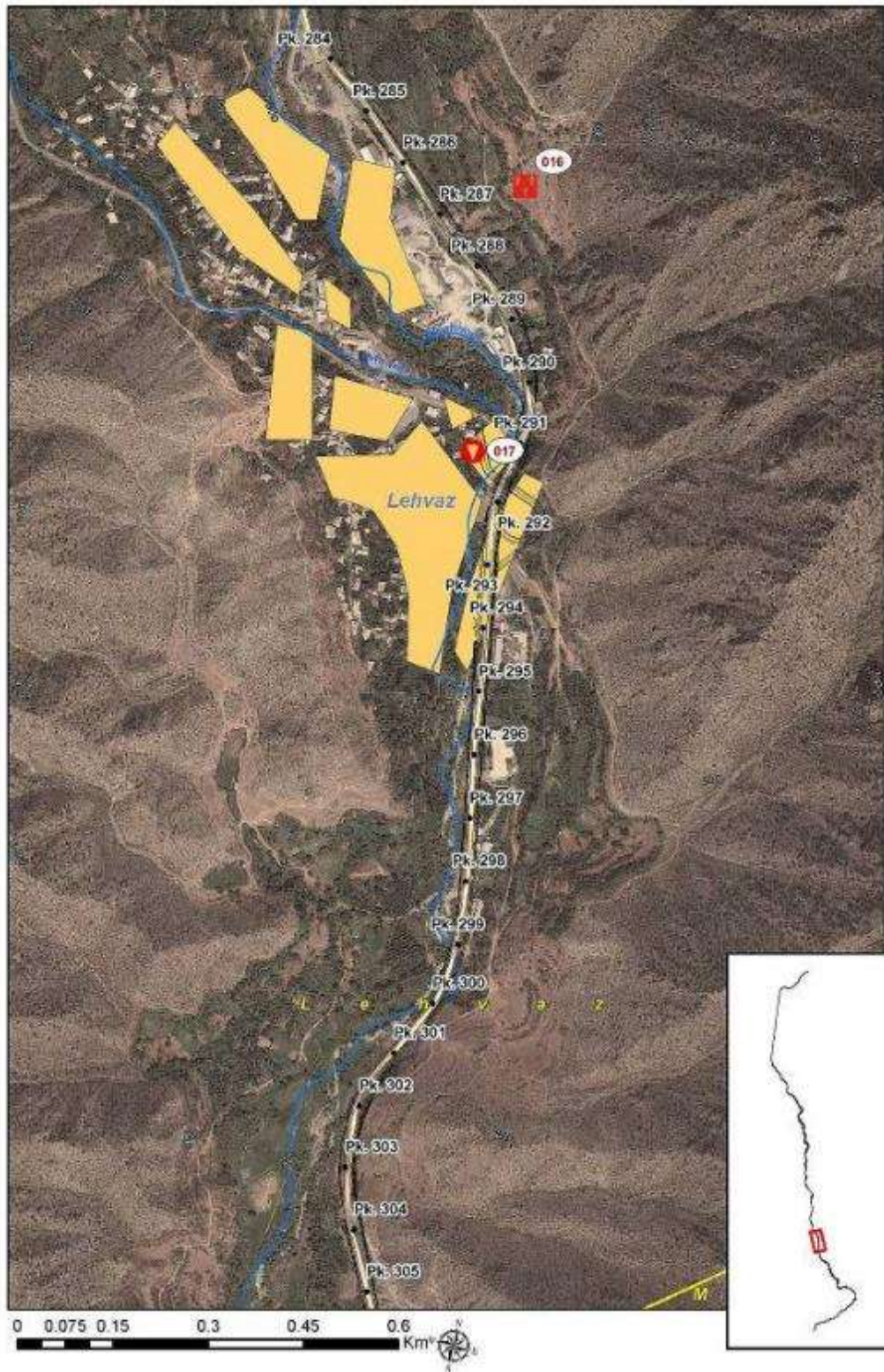


Figure 108: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz village, Pk 28.6 – Pk 30.5

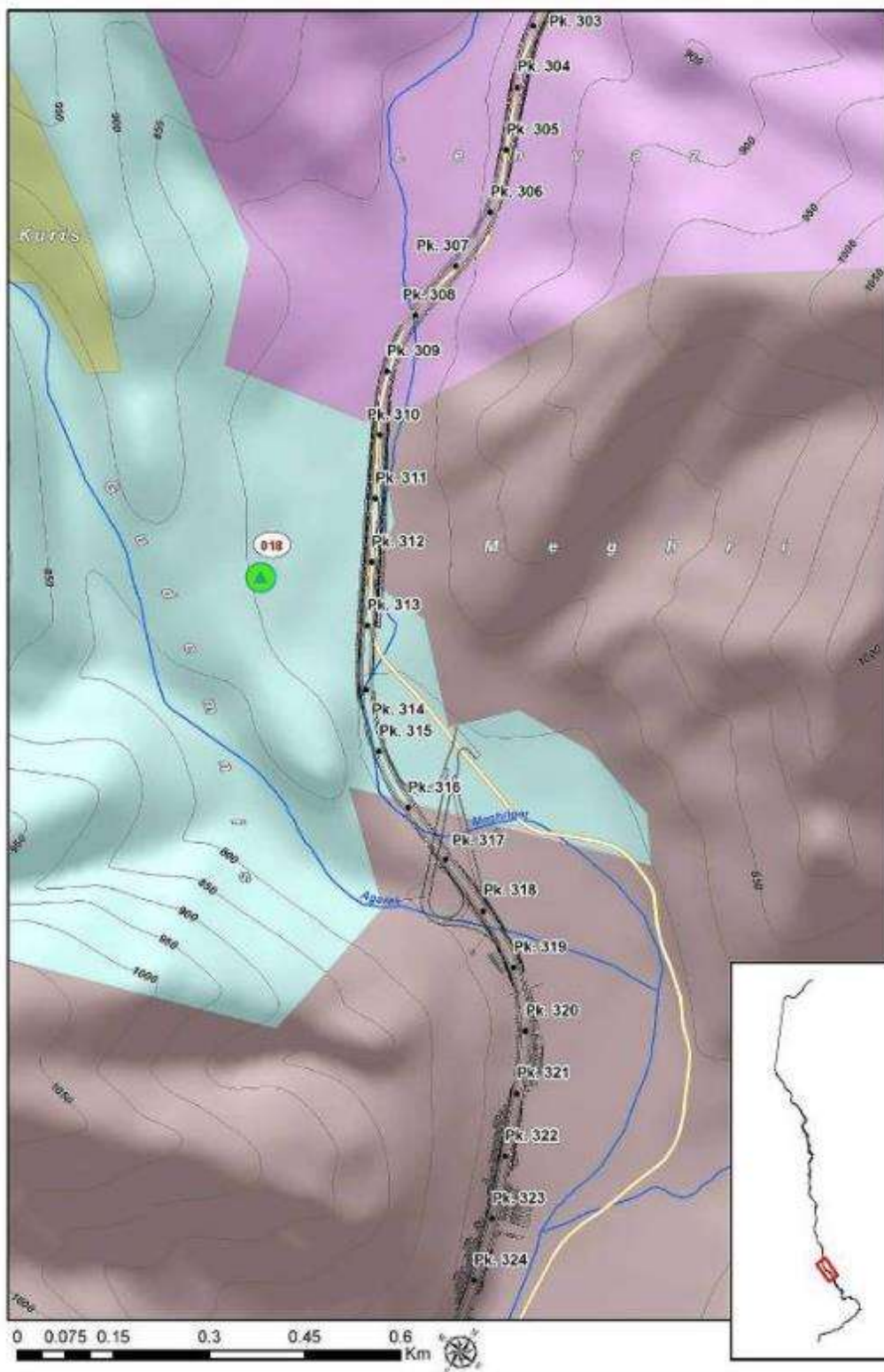


Figure 109: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz, Gudennis villages and Meghri city, Pk 30.5 – Pk 32.4



Figure 110: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Lehvaz, Gudemnis villages and Meghri city, Pk 30.5 – Pk 32.4

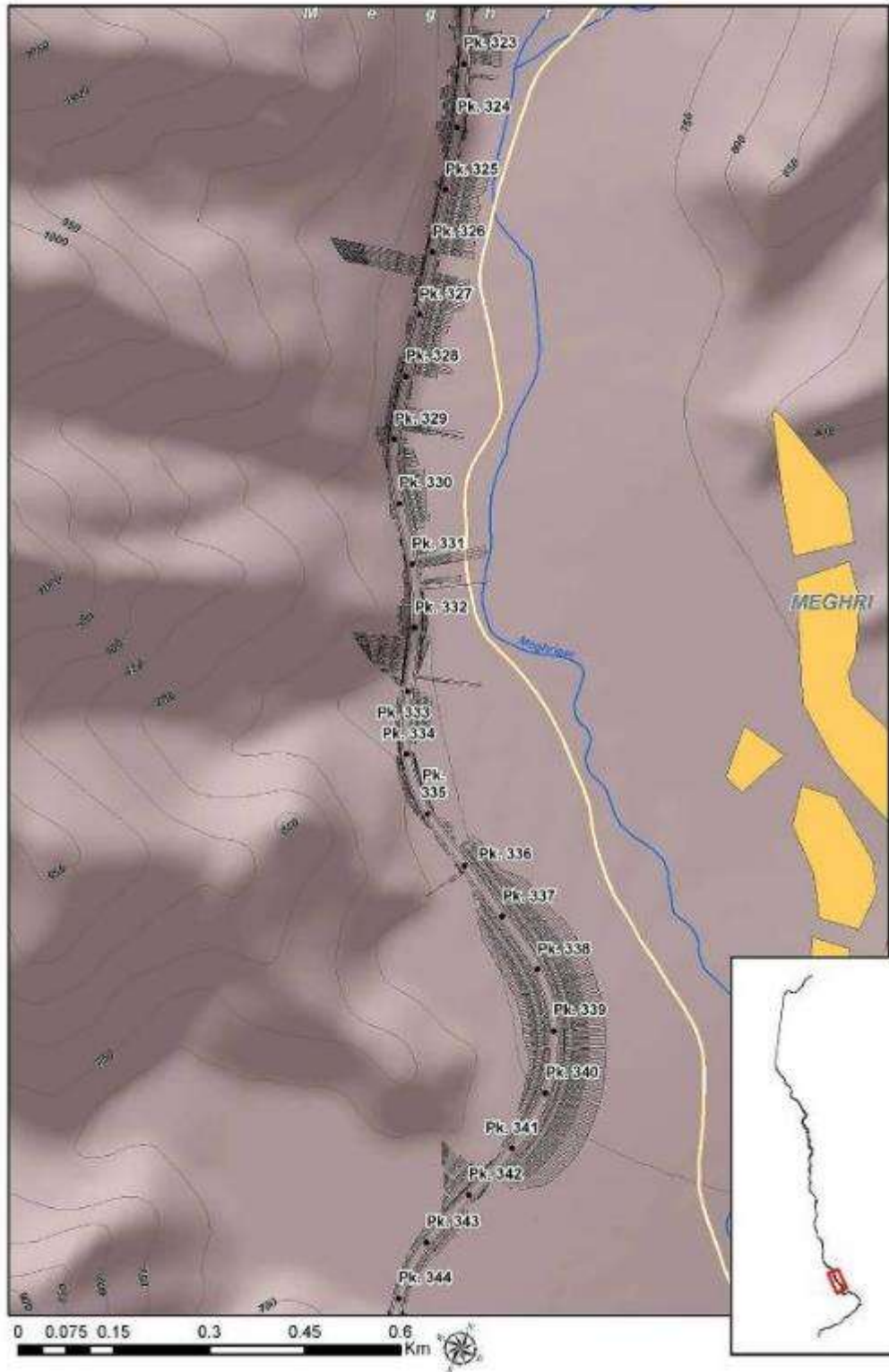


Figure 111: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 32.4 – Pk 34.4



Figure 112: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 32.4 – Pk 34.4



Figure 113: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 34.4 – Pk 36.7



Figure 114: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 34.4 – Pk 36.7

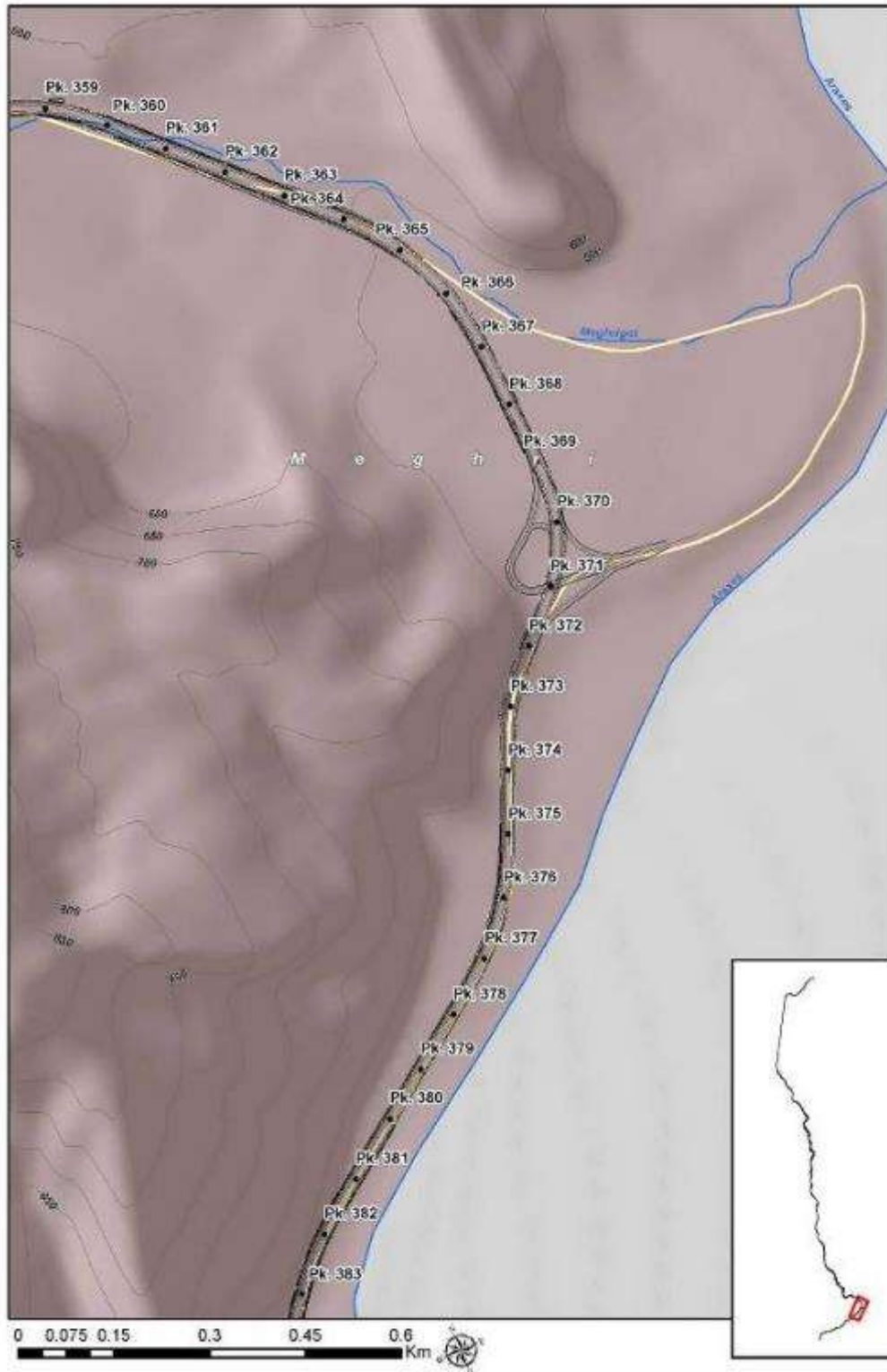


Figure 115: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 36.7 – Pk 38.3

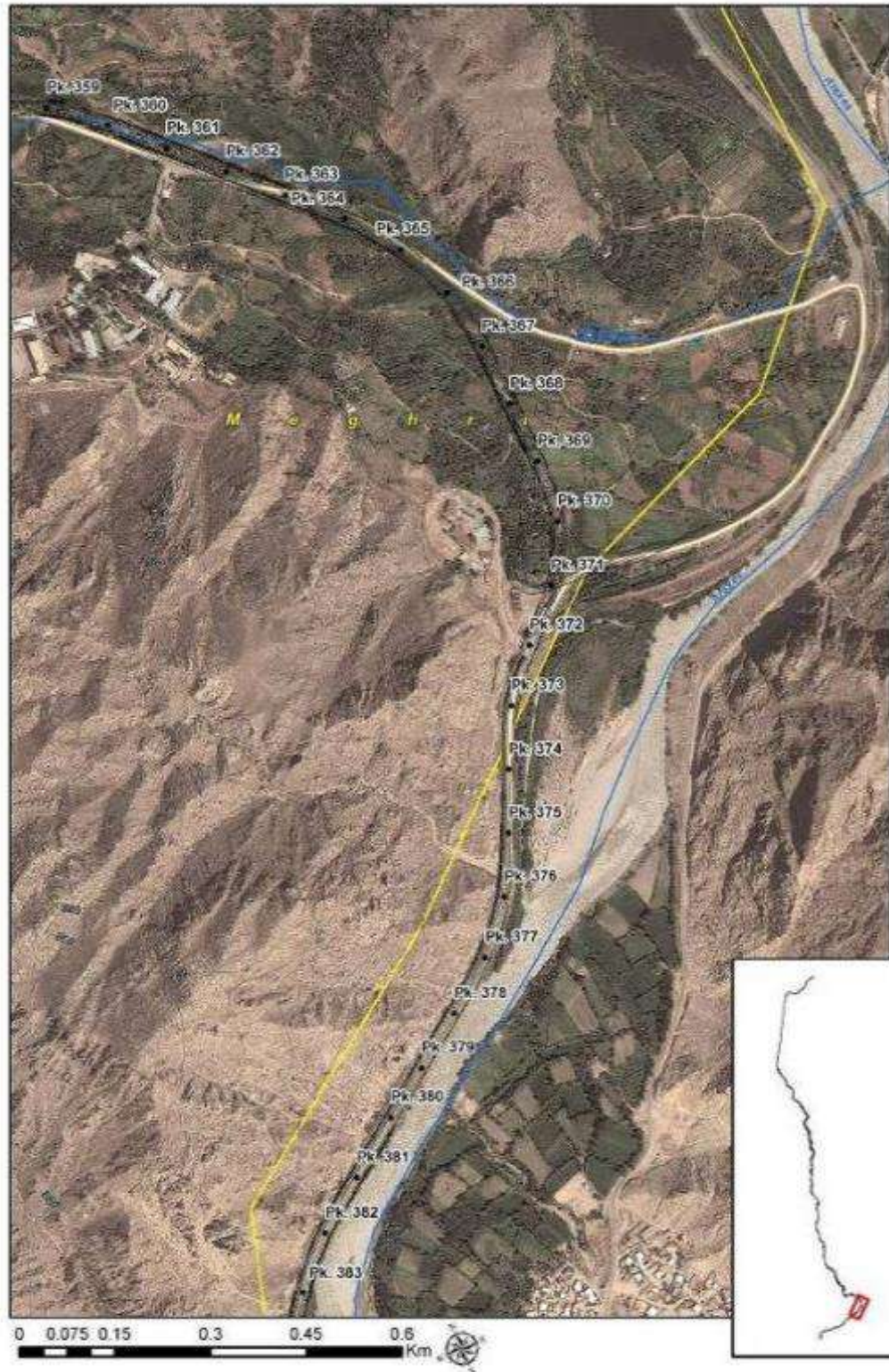


Figure 116: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city, Pk 36.7 – Pk 38.3

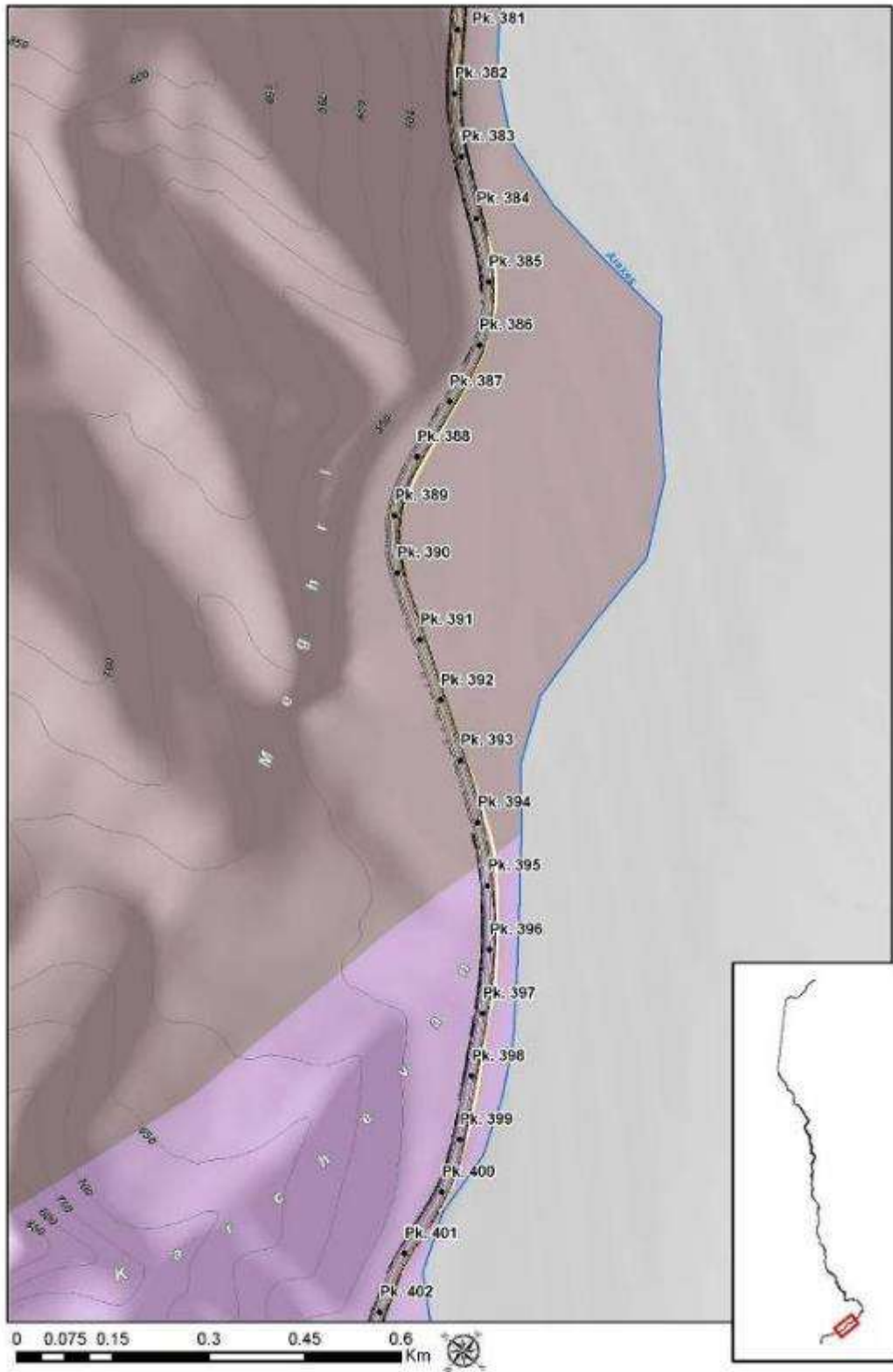


Figure 117: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city and Karchevan village, Pk 38.3 – Pk 40.2

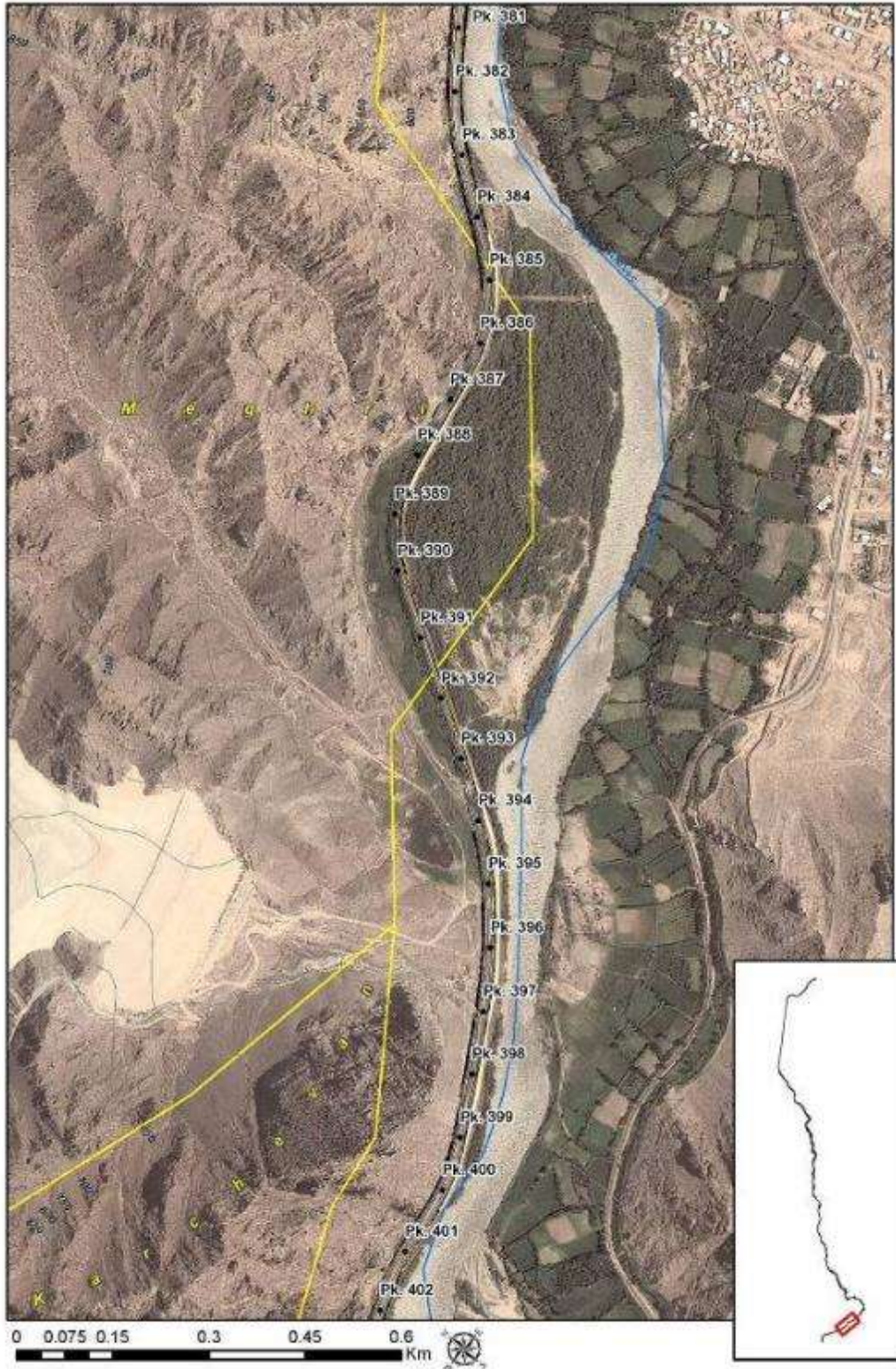


Figure 118: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Meghri city and Karchevan village, Pk 38.3 – Pk 40.2

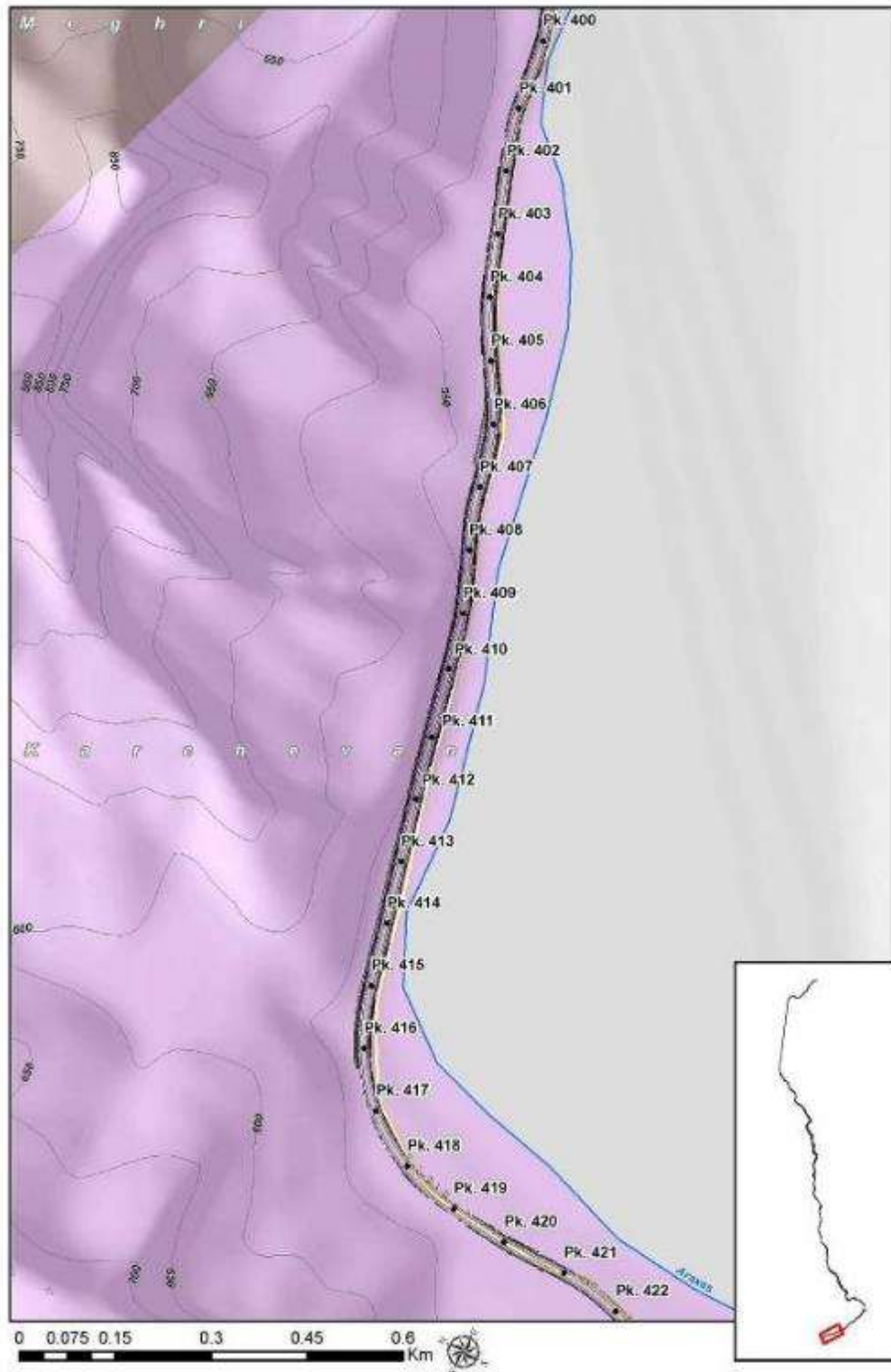


Figure 119: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Karchevan village, Pk 40.2 – Pk 42.0

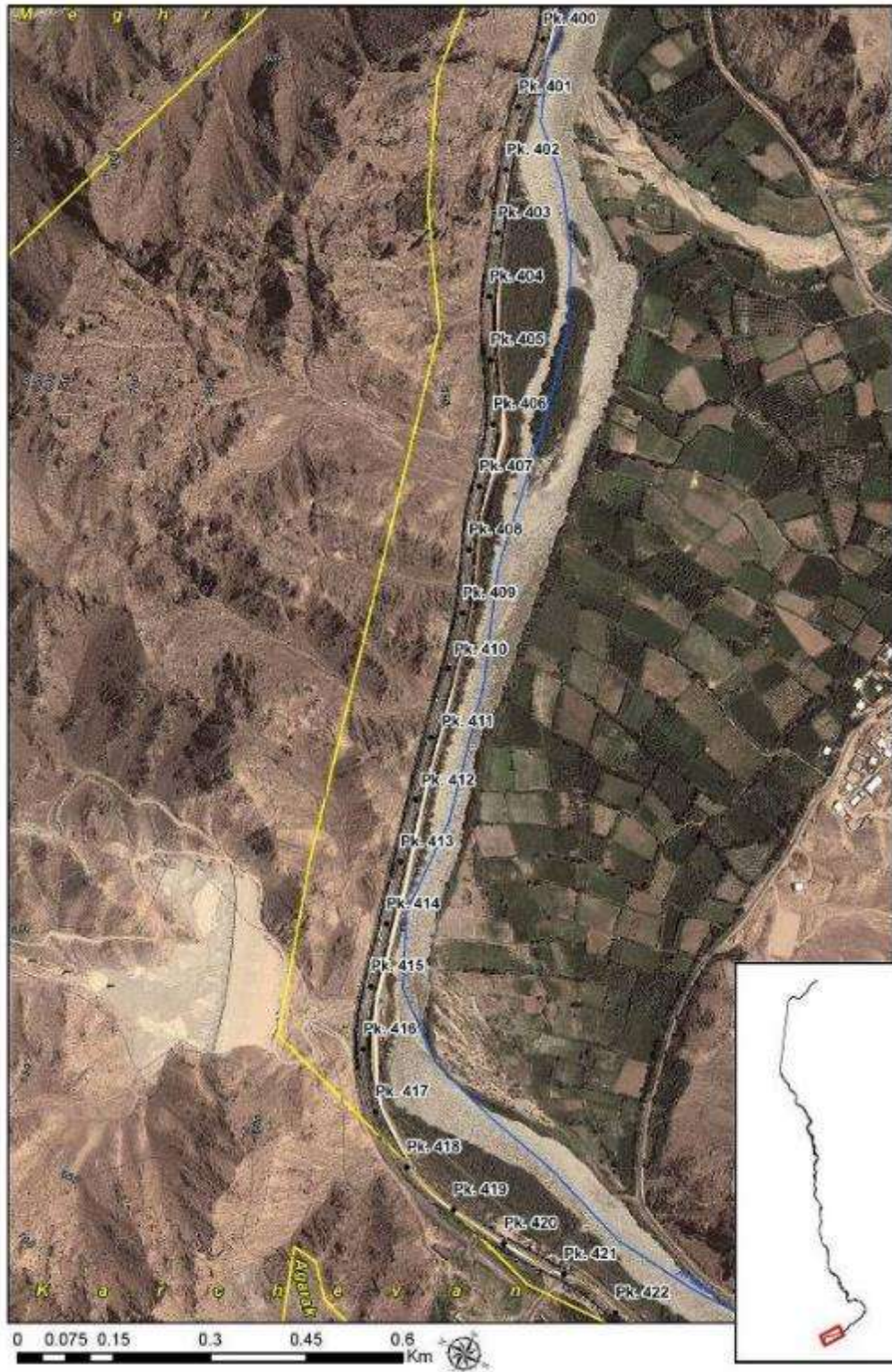


Figure 120: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Karchevan village, Pk 40.2 – Pk 42.0

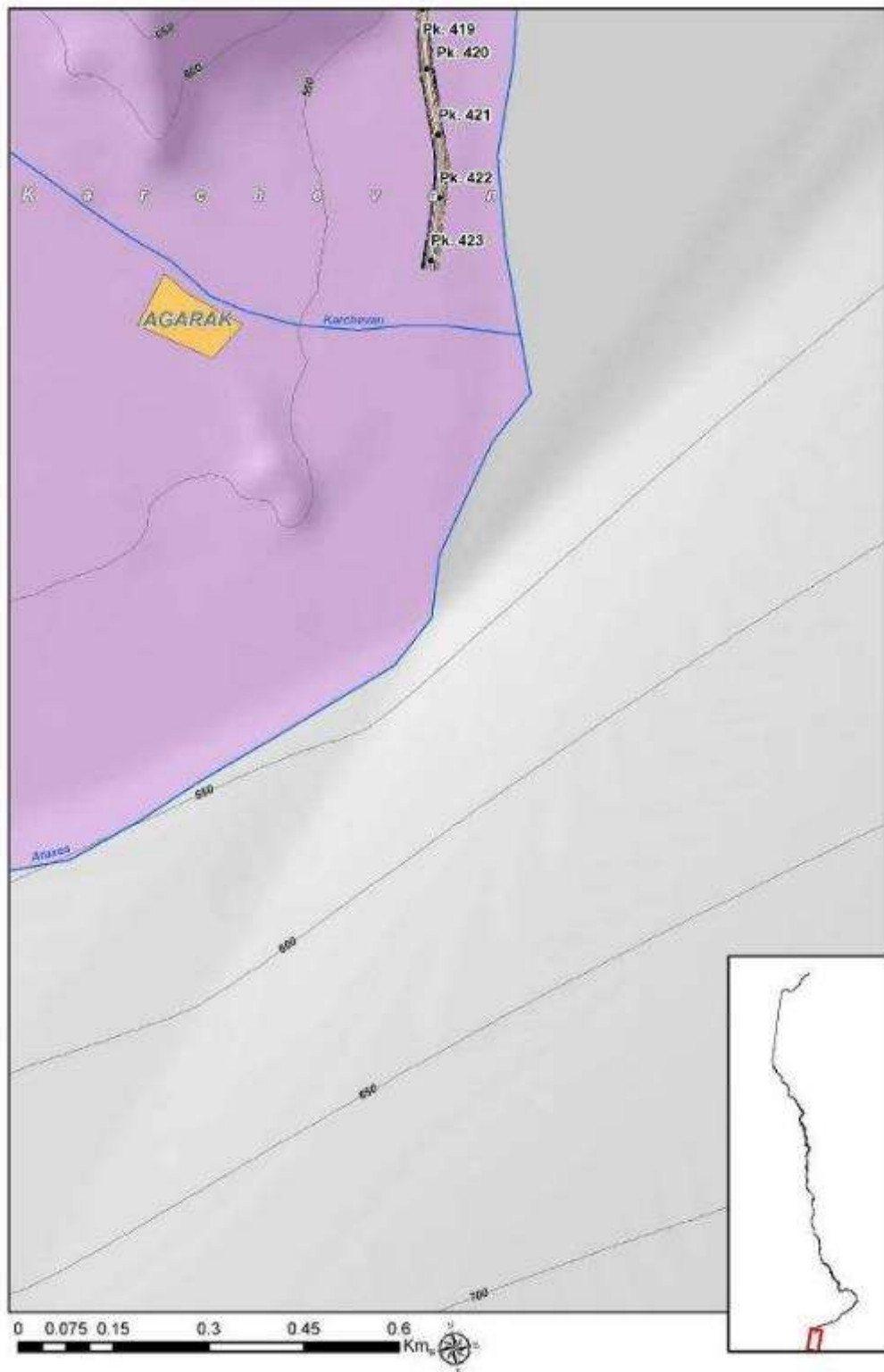


Figure 121: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Karchevan village, Pk 42.0 – Pk 42.3

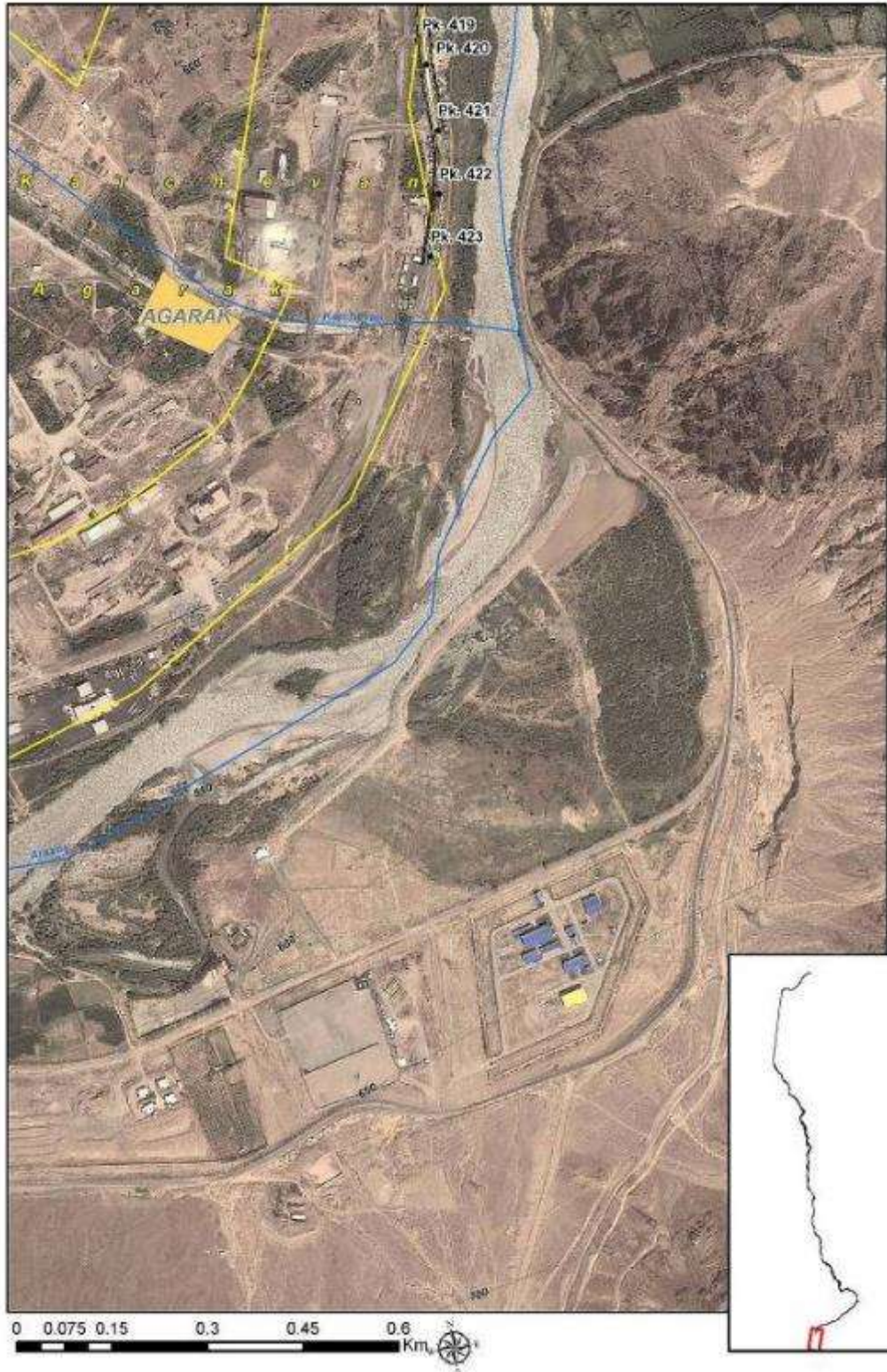


Figure 122: Kajaran-Agarak highway alignment (Tranche 4, Lot 1), Karchevan village, Pk 42.0 – Pk 42.3



Picture 1: Lernadzor necropolis. Portion of cromlech



Picture 2: Lernadzor necropolis. Partly destroyed burial structure



Picture 3: Lernadzor Archaeological Complex. Stratigraphic section



Picture 4: Lernadzor Archaeological Complex. A cist grave from the IV-V centuries AD



Picture 5: Lernadzor Archaeological Complex. A vessel visible in the section of the Chalcolithic layer, dated to the last quarter of the V Millennium BC



Picture 6: Lernadzor Archaeological Complex. Position of the Upper Paleolithic site at the base of the stratigraphic section



Picture 7: Old Lernadzor village remains. S. Astvatsatsin church (1661)



Picture 8: Old Lernadzor village remains. S. Astvatsatsin church from the west



Picture 9: Old Lernadzor village remains. Interior of the S. Astvatsin church



Picture 10: Old Lernadzor village remains. XVII-XVIII centuries cemetery around S. Astvatsatsin church



Picture 11: Tashtun. Remnants of uncertain structure



Picture 12: Tashtun. Remnants of uncertain structure



Picture 13: Late Medieval (XVII-XVIII centuries) bridge of Tashtun over the Meghri River



Picture 14: Late Medieval (XVII-XVIII centuries) bridge of Tashtun over the Meghri River



Picture 15: Late Medieval (XVII-XVIII centuries) bridge 1 of Lichk over the Meghri River



Picture 16: Late Medieval (XVII-XVIII centuries) bridge 1 of Lichk over the Meghri River



Picture 17: Late Medieval (XVII-XVIII centuries) bridge 2 of Lichk over the Meghri River



Picture 18: Late Medieval (XVII-XVIII centuries) bridge 2 of Lichk over the Meghri River



Picture 19: Late Medieval (XVII-XVIII centuries) bridge of Vardanidzor over the Meghri River



Picture 20: Late Medieval (XVII-XVIII centuries) bridge of Vardanidzor over the Meghri River



Picture 21: Vardanidzor. Traces of uncertain structures 1 (probably burials)



Picture 22: Vardanidzor. Traces of uncertain structures 1 (probably burials)



Picture 23: Vardanidzor. Main view of the Pushkag medieval village remains (XVIII-XX centuries)



Picture 24: Vardanidzor. Survived portion of the Pushkag medieval village remains (XVIII-XX centuries)



Picture 25: Vardanidzor. Survived portions of the ancient horticultural terrace system



Picture 26: Vardanidzor. A portion of the ancient horticultural terrace system



Picture 27: Vardanidzor. Unknown medieval village remains. Traces of wall structures



Picture 28: Vardanidzor. Unknown medieval village remains. Traces of wall structures



Picture 29: Vardanidzor. Uncertain, partly preserves structure



Picture 30: Portion of the Lehvaz cemetery



Picture 31: Portion of the Lehvaz cemetery



Picture 32: XIX century water mill in Lehvaz



Picture 33: The entrance of the XIX century water mill of Lehvaz



Picture 34: Gudemnis. An overview of the historical horticultural landscape



Picture 35: Gudemnis. A portion of historical horticultural landscape



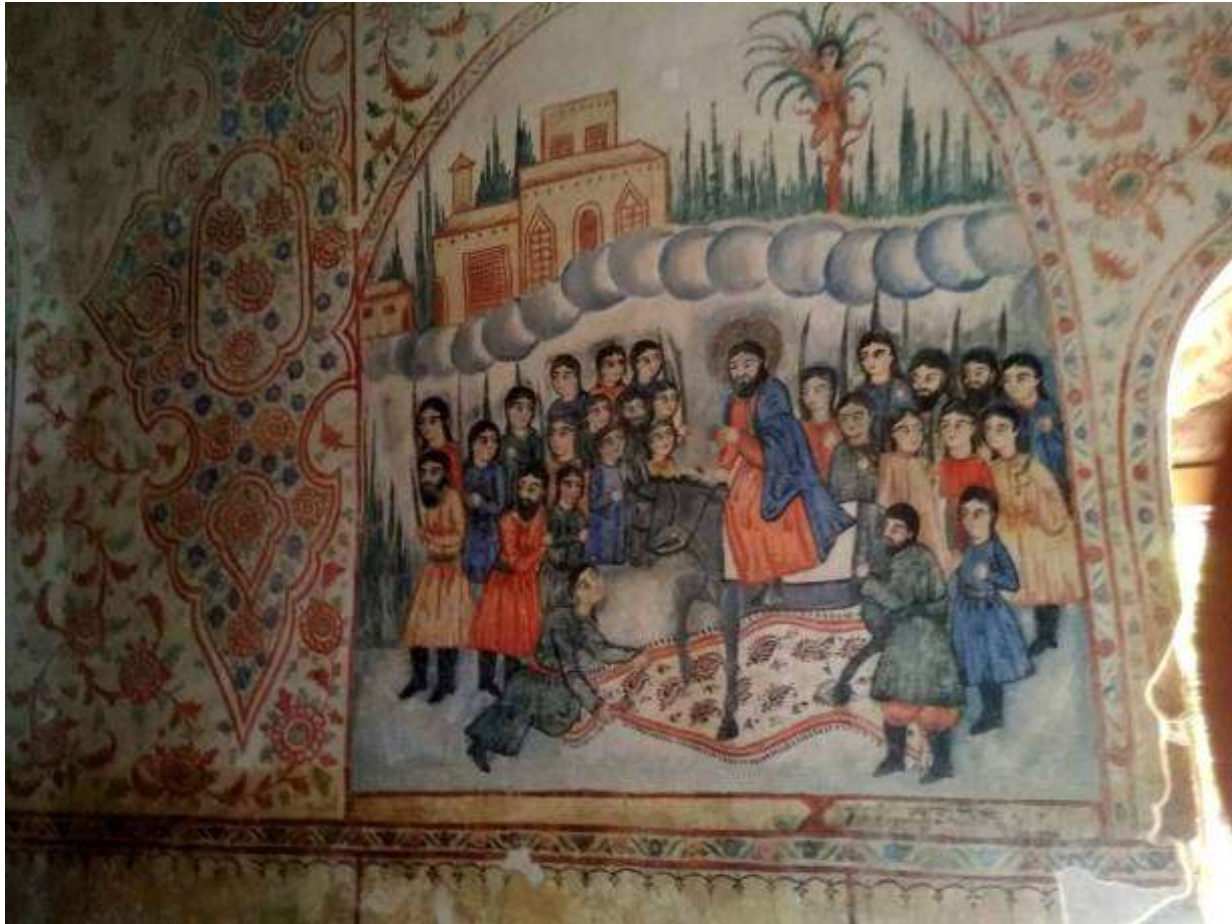
Picture 36: Meghri. Pokr Tagh. S. Sargis church (XVII century)



Picture 37: Meghri. Pokr Tagh. Southern view of S. Sargis church



Picture 38: Meghri. Pokr Tagh. XVII century frescos of S. Sargis church



Picture 39: Meghri. Pokr Tagh. Fresco fragment from S. Sargis church



ANNEX 10: DESCRIPTION AND LOCATION OF THE OFFERED DUMPING SITES FOR KAJARAN-AGARAK ROAD CONSTRUCTION

Five dumps are envisaged for the soil mass formed as a result of the construction works of the highway of Kajaran-Agarak, implemented within the framework of the project.

Two of them are located in the community of Kajaran, and the other three are in the community of Meghri. Below the locations of all the dumps are presented with respective descriptions:

Ecological impact assessment on exported geological material placement dumps in the community of Kajaran

Option 1: located on a 39°08'54,93" N, 46°11'29,94 "E, 1620 m.a.s.l. section:

It is a gorge, its two hillsides are covered with deciduous forests, in some sections – by glades. Fraxinus excelsior, Carpinus caucasica, Quercus iberica, Acer campestre, and Prunus domestica grow in the lower parts of the dump, where the construction waste is going to be concentrated. Rosa and Spiraea; L. grow on open areas.

The fauna is represented by vertebrates typical of the given biotope. The avifauna is not abundant, and it is mostly represented by Passeridae species: Erithacus rubecula, Phoenicurus phoenicurus, Parus major, Fringilla coelebs, Turdus merula, and Garrulus glandarius. In areas closer to the rivulet, in the shrubs, Periparus ater and Troglodytes troglodytes species were identified. From mammals, Dryomys nitedula, Martes foina, Canis aureus, and Sylvaemus uralensis can be found. Vulpes vulpes was identified on the way leading to the dump.

Option 2: located on a 39°07'23,51" N, 46°11'10,36 "E, 2070 m.a.s.l. section.

It is a gorge, its hillsides are covered with deciduous forests. From representatives of Dendroflora, Quercus macranthera, Acer ibericum, Acer campestre, Fraxinus excelsior, and Carpinus caucasica can be found. The grass cover is abundant.

The lower part of the gorge is plain; it is a humid meadow with humidity-loving vegetation and large puddles, where eggs and tadpoles of Rana macrocnemis were noted. Just like with the first gorge, a significantly large river flows down floor of this gorge as well. The avifauna identified here is more abundant than in the first gorge. Periodically Buteo buteo L Buteo rufinus species can be found. Motacilla alba, Prunella modularis, Saxicola rubetra, Turdus merula, Dendrocopos major, Muscicapa striata, Garrulus glandarius, and Pyrrhula pyrrhula species were identified in glades and shrubs. Capreolus capreolus was registered at the edge of the forest located on the left side of the gorge. Numerous traces of Canis aureus L Vulpes vulpes were identified on the road leading to the gorge and its plain section. Besides those, traces of Ursus arctos were identified on the way from the lower part of the gorge leading towards the beehive located at its entrance, which, as testified by the bee-keepers, periodically goes closer to the beehive and tries to pass through the electric shepherd, which is surrounding the hives. Lacerta strigata was recorded in shrubby vegetation.

Table 43: Description of exported geological material placement dumps in the community of Kajaran



h/h	Option 1	Option 2
1	<p>Location: is situated on a 2065 m.a.s.l. height, it is 415 m higher than the tunnel entrance. The total area of surface waters and polluted land lots formed as a result of accidents and leaks increases due to the high location. In order to move/place the geological materials exported from the tunnel on a higher location, more diesel fuel is spent which additionally pollutes the atmospheric air. Additional transportation traffic load is caused on the 6 km section of Kajaran-Meghri M2 road, if no additional road, bypassing Kajaran, is not constructed.</p>	<p>Location: is situated on a 1670 m.a.s.l. height, it is 20 m higher than the tunnel entrance. It is situated close to the village of Lernadzor and it is probable that the village will be imposed to additional noise and dust effect (needs to be measured). A gaspipe-line is installed in a distance of 70 m from the lower border of the recommended dump. It may become necessary to take extra measures in order to ensure its safety. If a short additional road is constructed from the tunnel entrance, there will be no additional transportation load on the existing roads.</p>
2	<p>There is an approach road in a 1545 m distance from highway M2 which needs improvement and widening.</p>	<p>There is an approach road with a length of 950 m, which needs improvement and widening. A water pipeline is installed along the approach road.</p>
3	<p>The natural environment of the recommended area has been less exposed to anthropogenic impact. It is a rocky gorge with a 30 m depth on the lowest point of the level of the approach road. The number of the logged trees is approximately 240 (<i>Salix caprea</i>, <i>Salicaceae</i>, a little amount of <i>Quercus</i> and <i>Carpinus</i>). However, additionally 100 more trees will be logged during the improvement of the approach road. The greater part of the area recommended for the dump is covered by rocky hillsides which practically lack the topsoil layer.</p>	<p>The natural environment of the recommended area has not been exposed to much anthropogenic impact. It is a rocky gorge with a 50 m depth on the lowest point of the level of the approach road. The number of logged trees is approximately 2300 (<i>Quercus</i>, <i>Carpinus</i>, <i>Acer</i>, a little amount of <i>Salix caprea</i> and <i>Salicaceae</i>. Additionally, 100 more trees will be logged during the improvement of the approach road. The greater part of the area of the recommended for the dump is covered by rocky hillsides, which practically lack a topsoil layer.</p>
4	<p>The drainage basin located in the area of the recommended dump, takes 2,26km² highland area. A stream with a flow speed of approximately 100 l/sec, flows through the gorge. Aside from that, a water source is flowing on the left slope of the gorge, the water of which has swamped the soil area of the plain floor of the gorge. These surface waters should be removed from the dump floor by building a trench with the parameters of the dump and a water stream with a length of 320 m. Nevertheless, the waters of precipitation falling on the surface of the dump (2,0 ha) are going to be absorbed and leak from the floor of the dump. Taking into consideration the higher location and the rock-cut relief, it is worth mentioning that the</p>	<p>The total area of the drainage basin located in the area of the recommended dump is 9,8 km². A tributary is flowing down the gorge with a flow speed of approximately 400 l/sec. These surface waters should be removed from the dump floor by building a trench with the parameters of the dup and a water stream with 620 m length. Nevertheless, the waters of precipitation falling on the surface of the dump (3,8 ha) are going to be absorbed and leak from the floor of the dump. The probability of the existence of groundwater basins and water flows is miniscule.</p>



	area recommended for the dump lacks groundwater basins and water flows.	
5	The area of the recommended dump lacks landslides, petrifications, and mudslides. The geological materials of the area are upper Eocene gabbros, granodiorides, quartz diorides, monocytes, nepheline syenites, and lycogranites. The possible earthquake magnitude is 8-9 or the maximum horizontal speed of the ground is 20-30 cm/sec ² . Kajaran is located on the tectonic fault of Garni-Agarak and on the epicenter of strong earthquakes.	The area of the recommended dump lacks landslides, petrifications, and muslides. The geological materials of the area upper Eocene gabbros, granodiorides, quartz diorides, monocytes, nefeline syenites, and lycogranites. The possible earthquake magnitude is 8-9 or the maximum horizontal speed of the ground is 20-30 cm/sec ² . Kajaran is located on the tectonic cault of Garni-Agarak and on the epicenter of strong earthquakes.
6	The area of the recommended dump occupies the <i>middle forest mountainous (up to 2300 m.a.s.l.) landscape zone</i> which affects the biodiversity of the area of the dump. The area requested for the dump is located in the <i>physical-geographical territory of Voghji (16)</i> . There are no endangered, vulnerable plant species in the area of the envisaged activity that need extra protection or are on the verge of extinction, registered in the RA Red Book or IUCN red list.	The area of the recommended dump occupies the <i>middle forest mountainous (up to 2300 m.a.s.l.) landscape zone</i> which affects the biodiversity of the area of the dump. The area requested for the dump is located in the <i>physical-geographical territory of Voghji (16)</i> . There are no endangered, vulnerable plant species in the area of the envisaged activity that need extra protection and are on the verge of extinction, registered in the RA Red Book or IUCN red list.
7	The climate of the area recommended for the dump is cold, with average air temperature of minus 6-8 in January, 0 to minus 2 in April, 12-14 in July, and 4-6 in October. The number of days with air temperature below 0 is 120 with stable snow cover from December 15.	The climate of the area recommended for the dump is cold, with average air temperature of minus 4-6, 2 to minus 0 in April, 14-16 in July, and 6-8 in October. The number of days with air temperature below 0 is 100, with a stable snow cover from the end of December.
8	The estimated volume of the dump is approximately 170 000 m ³ .	The estimated volume of the dump is approximately 650 000 m ³ .



Figure 123: Photo of the recommended area of the dumps with Google Earth program



Recommendation on the location of the external dump of exported geological materials in the section of the North-South road passing through Meghri

Dump "Tashtun -1"

The coordinates are: 39° 03' 58"N and 46° 11' 14"E. The total area is 5,0 ha, the parameters are 940 m, the average height of the charge is 20 m, the estimated capacity is 1 000 000 m³. The height above the sea level is 1740 m, it is in a distance of 3,6 km from the tunnel exit.

Advantages – a) it is safe if the dam is built technically correctly; b) has a large capacity, including possibility for expansion; c) there is no need to build approach roads; d) is quite close to the tunnel exit from where a exportation of a large amount of geological material is anticipated.

Disadvantages – a) Tashtun river flows down the gorge, and respective structures need to be built in order to reconstruct the river streambed; b) the gorge is partially forested; c) the slopes of the gorge are covered with bear rocks (perhaps – moraine), which need to be partially removed.

Flying over the slopes of the envisaged dump, Gypaetus barbatus, Accipiter nisus, Buteo buteo, Falco tinnunculus, Apus apus, Merops apiaster, and Corvus corax bird species were identified. Also, Caprimulgus europaeus, Lullula arborea, Monticola solitarius, Turdus torquatus, Sitta neumayer, Garrulus glandarius, Carduelis cannabina, and Emberiza cia bird species were registered. Laudakia caucasia and Darevskia raddei lizards were noted on rocky edges.

Dump "Meghri – cemetery orchards"

The coordinates are: 38° 53' 45"N and 46° 13' 28"E. The total area is 2,4 ha, the parameters are 630 m, the average height of the charge is 15 m, the estimated capacity is 345 000 m³. The height above the sea level is 790 m. Description: is a gorge covered with shrubs located in the surroundings of the road Meghri – Airport, which is nearly totally an orchard (Ficus carica, Punica granatum).

Advantages – a) it is safe if the dam is built technically correctly; b) it is not far from the rocky section of the North-South highway bypassing Meghri and Meghri's Pokr Tagh; c) the gorge is mostly dry throughout the year, although there definitely is a need for building a bypassing water pipeline system; d) there is no need to build approach roads.

Disadvantages – a) all of the location is occupied by an orchard; b) the capacity of the dump is not large; c) is applicable only for the highway bypassing Meghri since the impassibility of the roads of Meghri's Pokr Tagh cemetery makes restrictions for heavy trucks.

Dump "Ravine of the Meghri cemetery"

The coordinates are: 38° 53' 45"N and 46° 13' 28"E – the organic continuation of the previous dump. The total area is 0,9 ha, the parameters are 1300 m, the average height of the charge is 10 m, the estimated capacity is 118 000 m³. The height above the sea level is 790 760 m: Description: a ravine located in the surroundings of the road Meghri – Airport with a depth of 10 m and a length of 600 m. The exploitation of this dump is of a higher priority than the previous one.



Advantages – a) it is safe; b) the location is not rich in humus, and after charging it, the safety of the road of the Meghri Airport will increase; c) is not far from the rocky section of the North-South highway bypassing Meghri and Meghri's Pokr Tagh; d) the gorge is mostly dry throughout the year, although there definitely is a need for building a bypassing water pipeline system; e) there is no need to build approach roads.

Disadvantages – a) the capacity of the dump is not large b) is applicable only for the construction of the highway bypassing Meghri since the impassibility of the roads of Meghri's Pokr Tagh cemetery makes restrictions for heavy trucks.

The lower part of the hillsides is covered with phryganoid vegetation, and the upper hillsides – with semi-dry shrubs and rare Juniper. Traces of *Canis aureus* and *Vulpes vulpes* were identified on the hillsides and near the landfill. A couple of *Mustela nivalis* was actively studying the garbage piles of the household landfill. Fresh traces of soil accumulation resulted from the digging of *Meriones persicus* were noted on the dry hillside. Two species of *Oenanthe oenanthe* - *Oenanthe finschii* and *Oenanthe isabellina* were chasing each other with screams evidently showing a fight for space. A couple of *Corvus corone* & *Pica pica* was digging the waste, and a *Lanius senator* was sitting above – on the high hillside, with a big grasshopper in its beak. *Sitta neumayer* was studying the small shrubs of grass and rock cracks in the small rocky protrusions of Juniper trees. *Sitta tephronota* is feeding its chicks in Juniper, along the highest border. From reptiles, *Eryx jaculus*, *Laudakia caucasia* & *Darevskia raddei* species were registered in the area.

Dump "Araksashen"

This dump is located in a distance of 2,4 km from the road intersection of Meghri-Araks valley. The coordinates are: 38° 54' 15" N and 46° 16' 204" E. It is located in a dry gorge and probably used to be a quarry in the past. Now it is partially utilized as an industrial landfill for the nearby stone production factory. The suggested area for the dump is made of 2 mine cavities, however, there is a possibility to expand the dump once the cavities are filled, including the filled cavities. The average height above the sea level of the dump is 580 m. Below we are presenting you approximate parameters of the dumps of Araksashen:

Dump Araksavan – 1. Total area - 1,96 ha, perimeter – 580 m, average charge height – 15 m, capacity - 294 000 m³.

Dump Araksavan – 2. Total area - 2,1 ha, perimeter - 650 m, average charge height - 15 m, capacity - 315 000 m³.

Dump Araksavan – 3. Total area - 8,2 ha, perimeter – 1200 m, average charge height – 10 m, capacity - 820 000 m³. The total capacity of the dump of Araksavan is 1 429 000 m³.

The dumps that formed here become applicable if they are discussed and approved by the stakeholders (Municipality of Meghri, interested members of the society, highway construction organizations, etc.).

The area is construction and household waste a landfill. The height of the location starts from 600 meters. The poor vegetation is represented by *Tamarix* and *Atraphaxis spinosa*. *Amigdalus fenziiana* grows on the surrounding hillsides. *Saccharum officinarum* grows in small depressions, where rainwater accumulates. Despite the scarcity of vegetation and incredible heat, the area attracts quite a few members of the fauna. Reptiles are represented by *Tenuidactylus caspius*, *Trachylepis septemtaeniata*, *Eumeces schneideri*, *Ophisops elegans*, *Eryx*



jaculus, and *Macrovipera lebetina* species. From birds, *Gypaetus barbatus*, *Gyps fulvus*, *Buteo rufinus*, *Aquila chrysaetos*, *Falco tinnunculus*, and *Falco peregrinus* fly in the area of the open pit excavations. During the nesting season, this area attracts *Alectoris chukar*, *Ammoperdix griseogularis*, *Coracias garrulus*, *Oenanthe hispanica*, *Oenanthe finschii*, *Oenanthe chrysopygia*, *Sylvia communis*, *Parus lugubris*, *Sitta tephronota*, and *Petronia brachydactactia* bird species. In spring, *Francolinus francolinus* couples appear on the border between the excavations and summer cottages. The permanent residents of this area are mammal species of *Martes foina*, *Canis aureus*, *Vulpes vulpes*, and *Meriones persicus*. *Capra aegagrus* can be found on the excavation hillsides rarely, but during every winter time.



Figure 124: Photo of “Tashtun – 1” dump by Google Earth program

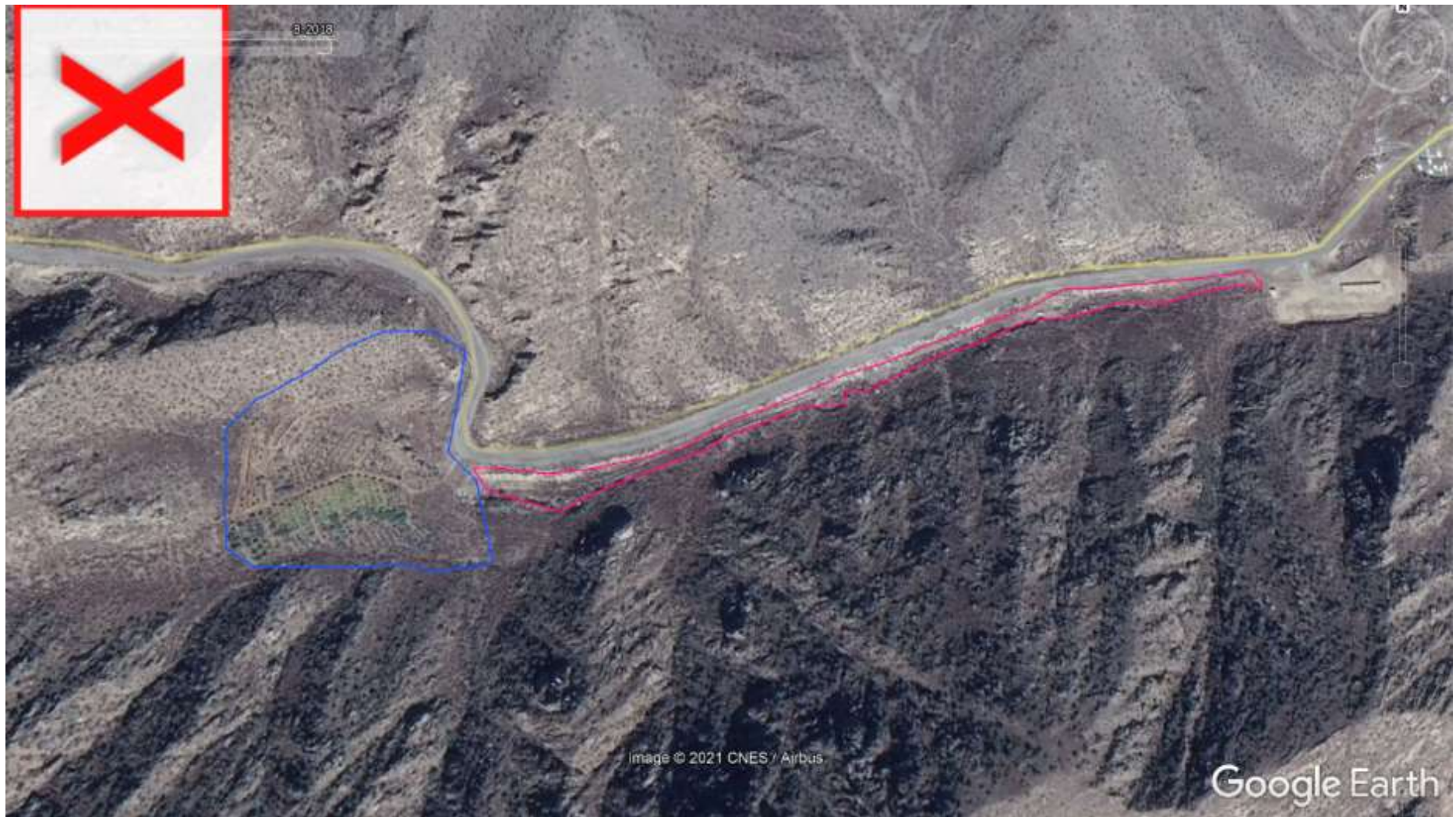


Figure 125: Dump site “Meghri – orchard” and dump site “Meghri cemetery – ravine”, photo by Google Earth program

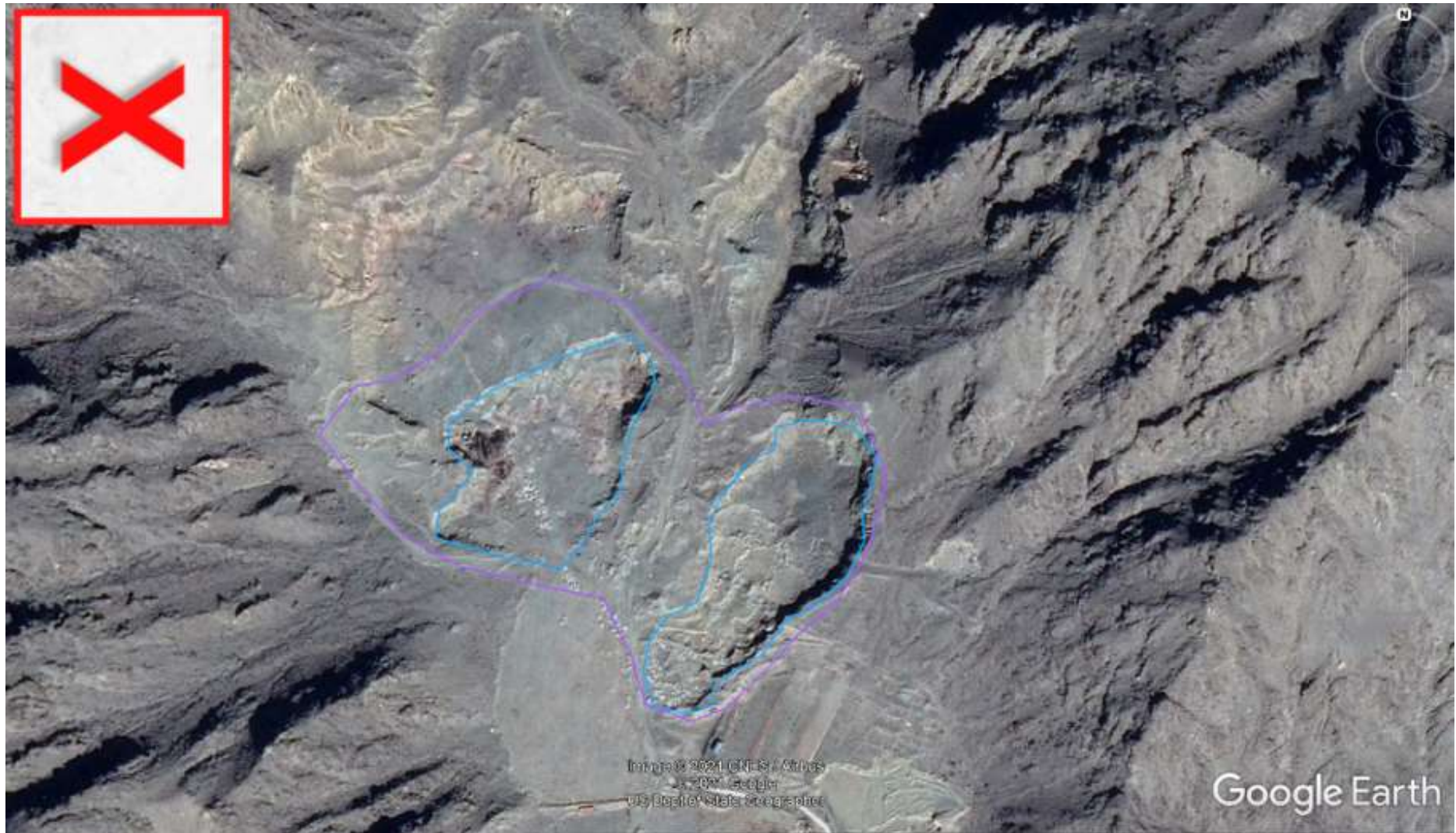


Figure 126: Dump sites “Araksashen – 1, Araksashen -2 and Araksashen – 3”, image by Google Earth program



ANNEX 11: PUBLIC CONSULTATIONS

Four public consultations took place during the initial and main phases of the environmental expertise in the communities of Meghri and Kajaran. The public consultation minutes and pictures are presented below:

18.03.2021, town of Kajaran



MINUTES

Kajaran

18.03.2021

The public consultation (first consultation) meeting regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment



program, Tranche 4 was held on March 18, 16:00 in the Municipality of the town of Kajaran, Syunik province, RA.

The meeting was attended by representatives from the Municipality of Kajaran, “AM” LLC, “RD” SNCO, and IRD organization.

Garegin Gabrielyan, representative of the Municipality of the town of Kajaran, Head of the Department of Agriculture, Environment, Economic Development, and Programs made the opening remarks. He thanked all the attendees for their participation and mentioned that they were going to hold consultations regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program, Tranche 4. He then invited Narek Zulalyan, representative of “Road Department” SNCO to make his remarks.

N. Zulalyan introduced the participants of the consultation and noted that all the respective specialists were present who would present the technical, environmental and social aspects of the project. The project manager Karen Badalyan also presented the designing company and invited their representative Andrea Bonci to make his remarks.

A. Bonci presented the technical aspect of the project in detail, showing respective maps and materials. He presented the entire topic in English, and his speech was translated into Armenian by the representative of IRD organization, Gevorg Voskanyan. The following questions were made during his speech:

Question 1: A. Bonci was requested to clarify the location of the envisaged tunnel and its entrance, which is going to be closer to the town of Kajaran.

Response: A. Bonci showed the location of the tunnel on the map and made appropriate comments.

Question 2. A. Bonci was requested to mention how many kilometers the road would be shortened for.

Response: A. Bonci presented not only the shortening of the road in detail, but also emphasized the importance of time saving. He mentioned that with the shortening of the road, the time that needed to be spent on passing that road would also be cut.

Question 3: A. Bonci was asked what standards the tunnel safety was going to be built with and whether the peculiarities typical of Armenia had been taken into consideration.

Response: A. Bonci stated that the building of the tunnels was going to be implemented in compliance with the European standards, which are among the best in the world, also taking into consideration the local specifics and in cooperation with the relevant bodies of the RA. “RD” SNCO representative Armen Bodoyan also noted that as the client of the project, they were going to request R-modeling:

Question 4: A. Bonci was requested also to clarify issues related to seismic safety.

Response: he mentioned that they were guided by respective European norms, which also required taking into account the peculiarities of the given area, hence, the high seismic activity typical of Armenia is also being considered.



Question 5: a question was raised on whether respective geological studies had been conducted or whether the data was retrieved from already existing sources.

Response: A. Bonci said that the initial data was taken from the existing sources, whereas the geological studies were in progress conducted in phases. The results of the geological studies will be finalized during the main phase.

Question 6: a question was asked about the category of the road and its potential.

K. Badalyan mentioned that it was envisaged to construct the road in category 2, however, with the potential to upgrade it to category 1. He described the advantages of that project (version) in detail.

After A. Bonci's speech the floor was given to environmental expert Mikael Tevosyan. He introduced himself and mentioned that the project was classified under "A" category, based on which the examination process would comprise two phases that envisaged three more similar public consultations. Following that he presented the main environmental risks and the measures for their mitigation. The following questions were raised during his speech:

Question 1: M. Tevosyan was asked what the total square and volume of the displaced soil layer would be.

Response: M. Tevosyan and G. Voskanyan mentioned that there is information available about the volume. As for the total square meters, we will have clarity only after clarifying the respective placement areas. A. Bodoyan described the placement norms and criteria.

Question 2: a question was asked connected with the safety of the removal of geological materials. Being located close to the mines, will not the removed geological materials pose any hazard on the environment?

Response: M. Tevosyan stated that the risks were there, and that issue would be thoroughly investigated and respective measures would be developed.

Question 3: a question was asked regarding the biological diversity studies, as well as engaging locals (also hunters) in those works.

Response: M. Tevosyan mentioned that the studies on biodiversity would be conducted by high qualified respective specialists. They also have a practice of involving the local population.

Question 4: A question was asked about the duration of field works.

Response: M. Tevosyan stated that the field works mostly depend on weather conditions.

Consultations were dwelled upon the slots with soil layer accumulation. The specialists made respective comments.

Question 5: the attendees were interested to know how the identification of archaeological finds was going to be conducted.

Response: M. Tevosyan mentioned that there was such a practice and noted that prior to starting the works, the workers of the construction company took respective trainings which allowed them to identify the finds.



After M. Tevosyan finished his remarks, representative of “Ed Em” LLC , Sos Lparyan was invited to speak. He presented the social aspect of the project and its main issues in detail. The representative of “RD”, Lilit Dilanyan made additional comments.

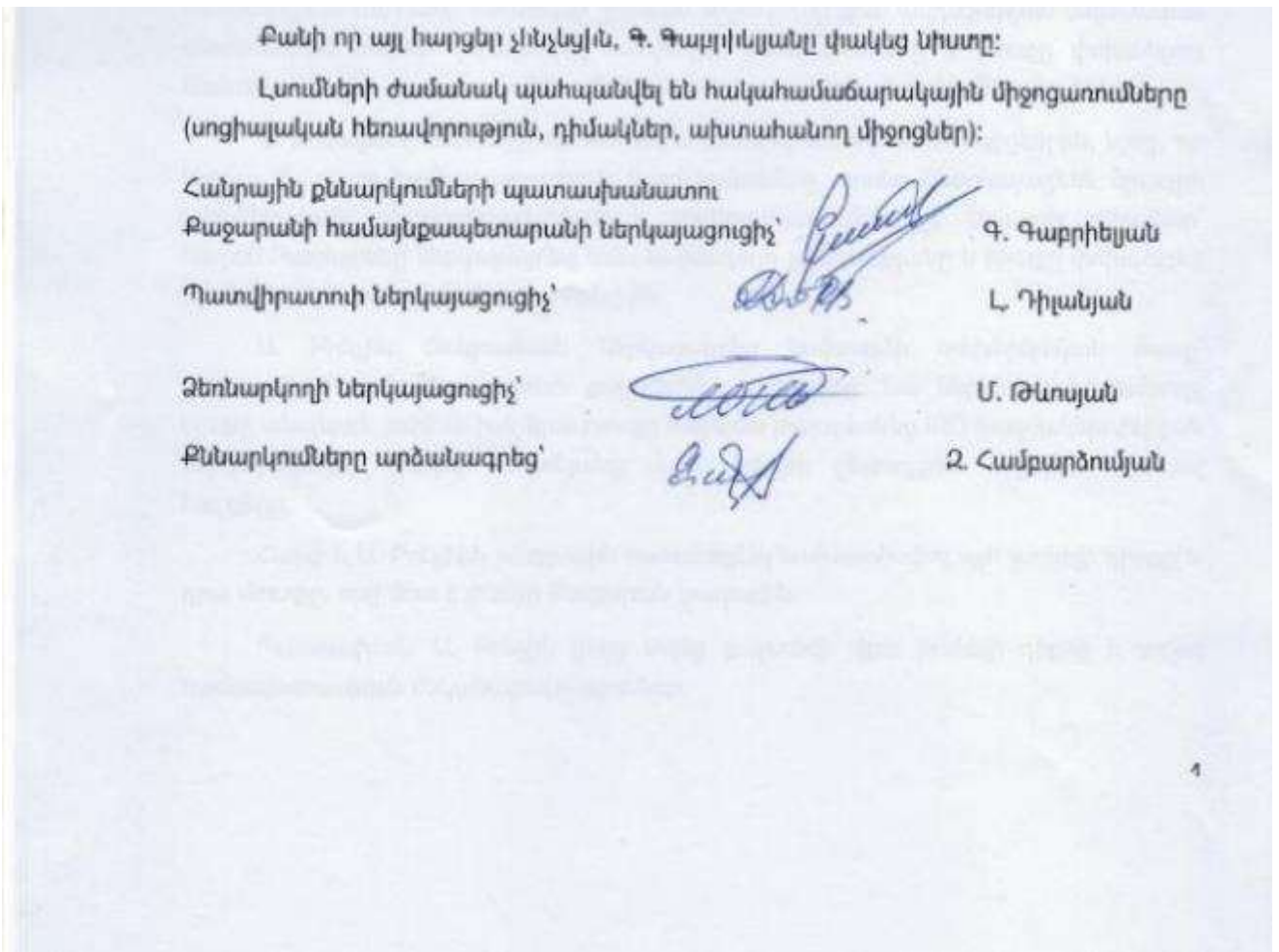
A proposal was made to consider as an economic benefit the fact that the equipment used for the construction or some of its parts could be produced in Armenia, hence creating an opportunity to make less expenses. The specialists welcomed her proposal, however, they mentioned that it was a very strategic proposal and it would not be possible to be implemented within the framework of this project.

G. Gabrielyan asked what was going to the socio-economic benefits of the broader community and how the main damages (if any) posed to the community were going to be managed.

The specialists made respective comments.

With no other questions being asked G. Gabrielyan called the meeting to an end.

All the anti-pidemic measures (social distancing, masks, and disinfectants) were maintained.





19.03.2021, town of Meghri





Minutes

Of public consultations regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program, Tranche 4

Meghri

19.03.2021

The public consultation (first phase) meeting regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program (NSRCIP), Tranche 4, was held on March 19, at 11:00 in the Center of Aesthetics in the town of Meghri, Syunik province, RA.

The awareness on the public consultation was ensured through the official website of the Municipality – meghri.am, their Facebook page, “Republic of Armenia” daily newspaper, as well as billboard announcements.

The public consultation was moderated by the Deputy Head of the Community of Meghri, Syunik province, RA, Armen Samvelyan, jointly with Narek Zulalyan, the client of the project and Head of the Department of Project Management and Procurement of “Road Department” SNCO, RA Ministry of Territorial Administration and Infrastructures, as well as Deputy Team Leader of the Project consulting organization, “IRD Engineering” and “J.P. Engineeria” JV, Andrea Bonci.

The meeting was attended by employees from different departments of the Municipality of Meghri, the Head of the Urban Construction, Land Use, Agriculture, and Property Management, Mher Ghazaryan, representatives from “IRD Engineering”, “J.P. Engineeria” JV, and “Road Department” SNCO, and local residents (the list of participants, along with their signatures and the video of the meeting are attached).

A. Samvelyan made opening remarks welcoming the participants to the public hearing. He talked about the objective of the event and added that specialists were present at the public hearing, who would show in detail how the construction of the road corridor was planned, which sections from the territory of the community of Meghri would be included in the works, and encouraged active participation in the consultation. He added about those changes might be made to the project after the getting the opinion formed as a result of the preliminary public hearings. Separate design/layout works are only launching now, and soil, ground and other investigation works are in progress.

A. Samvelyan also highlighted the importance of the project and the strengthening the connection between the community and the capital. Mr. Samvelyan invited Narek Zulalyan, the Head of the Department of Project Management and Procurement of “Road Department” SNCO, RA Ministry of Territorial Administration and Infrastructures, the company that is carrying out the project, to make his remarks.

N. Zulalyan: he mentioned that the Kajaran-Agarak road section project of NSRCIP Tranche 4 (around 45 km) was financed by the Eurasian Fund for Stabilization and Development, which was governed by the Eurasian Development Bank. The Project is currently in the designing phase. The preliminary draft was submitted by the Consulting organization last year in December, the works are still in progress and the final project will be presented in the month of July of this year. The Consulting company was selected in 2019 through a bidding process and a contract was signed with Italian “IRD Engineering” and “J.P. Engineeria”



the representatives of which are present and will present the technical, environmental, and the social impact related issues in detail. Today's public consultations will consist of three phases. During the first phase, the Deputy Leader of the designing team will present the technical solutions which have been used in the initial designing phase. The second phase will include consultations on environmental issues and the third phase consultations will be on social impact issues. N. Zulalyan gave the floor to the Leader of the designing team, Andrea Bonci.

Andrea Bonci: he mentioned that the beginning of the new road currently being designed would coincide with the ending point of the newly designed Sisian-Kajaran road. The starting point is approximately in a one km distance from Lernadzor. The small transportation block of Lernadzor and Kajaran's larger block, which ensure the entrance of transportation flow to the town of Kajaran, will also ensure entrance to the new tunnel currently being designed. The envisaged tunnel will be about 7 km long and it will give an opportunity to avoid currently existing hairpins of the road, as well as decrease using the mountain pass of Meghri (2535 above the sea level), which will significantly increase the safety level of the road and will provide an opportunity to avoid the complications of ensuring passability on the mountain pass of Meghri in winter.

The tunnel exit is going to be built on the existing road and from that point on it will continue further 3 km along the existing road, ensuring all the parameters in accordance with the category of the envisaged road. All the existing residential areas will be bypassed. We will have one more tunnel approximately in the 16th km from the counted base, which will be 400 m long. Following the tunnel, the road will continue with the existing route, in parallel with today's existing road all the way until the community of Vardanidzor, where the transportation block will ensure connection between the existing road and the new one currently in development. It would be possible to use both roads due to that transportation block. The road continuing from that block or down the community of Vardanidzor continues with the existing road route since its criteria allow for the possibility to develop the new route. Another transportation block is in the plans which will ensure the connection between the existing road and the new one currently in development, also to Meghri. Many options have been discussed for Meghri, and the option that will have the minimum adverse effect on the local population has been selected. The new routing that will go in parallel with the existing road to the mountain slope, which will bypass the existing road, i.e., the transportation flow will not enter the community, instead, it will move towards the mountain, is under consideration as the best option. In order to limit the amount of land works, as many artificial constructions as possible will be used. For that reason, we will have a bridge in that section with approximately 800m length, also 3-4 bridges subsequently, a tunnel which will allow implementing the location of the route with minimal damage on the given landscape, after which we will connect with the existing M2 road. A transportation block is in the plans in order to ensure connection with Agarak. A transportation plan is also planned at the tunnel exit area which will ensure connection between the existing road and the new one currently in development. As a result of the new route, the existing 61-km road will be shortened, reaching approximately 42 km, thanks to which the time for reaching from one point to the other will also be cut in about 62 minutes. The works of the first section – from the route start to the tunnel exit, will take approximately 5-6 years, since they include building of a big tunnel, and the second one – towards the section entering Meghri, will take approximately 3 years.

The following questions were raised by the participants of the public consultations:



Khalafyan Garik – Question: where will the first tunnel start after the customs checkpoint?

Response: the first tunnel which will appear after the customs checkpoint, is located a little above cemeteries of Poqr Tagh district of the town of Meghri.

Gharakhanayn Aram – Question: is it possible to specify where the route will pass by, with more detailed description, in order to understand the future status of the privatized lands?

Response: the first phase will give only the preliminary description of the route, where the possible environmental and social impact is described. That means that the principles, by which the project's social and environmental impact is going to be assessed and compensated, will be described. In order to understand which land lots specifically the route will pass along, consultations are planned to be organized in the further phases of the project.

Mkrtumyan Garegin – Question: does this project envisage any estimation according to the residential areas of the community of Meghri – how much agricultural land is going to be alienated or be fallen under construction?

Representative of “Road Department” SNCO, Head of Social Impact Management Service, L. Dilanyan responded to the question.

The project is preliminary, which means that the works of this phase do not allow to identify the zone that is going to be alienated. The alienating zone includes the maximal limit for carrying out construction works.

What does social impact mean?

The project is being implemented with the financing of the Eurasian Development Bank, which, in turn, has allowed for using the frame and resettlement circle of the land lots utilized within the framework of North-South road corridor investment project, which was mostly used within the scope of Tranches 1; 2; and 3. This has certain methodology and principles which define the alienation and resettlement methodology and principles to be used. It, in its turn, suggests description of building-constructions, lands, trees, and crops located in the impact zone, based on which their owners will get compensation.

According to preliminary data, 8 communities will be impacted during the entire program implementation, which are Gudemnis, Lehvaz, Lernadzor, Lichk, Meghri, Kajaran, Tashtun, Vardanidzor, and around 800-850 land lots for the total of 45 km. From the territory of Meghri, approximately 200 land lots will be impacted. A LORP will be developed, which will first of all include the legal framework of the land lot alienation and resettlement, compensation rights and assessment methodology, the main group of people subject to be impacted, alienation and resettlement process phases and their organization grounds, mechanisms for handling complaints, and principles of land alienation and resettlement impact monitoring.

The types of impact (losses) imposed as a result of the project implementation, subject to compensation include: agricultural and non-agricultural lands, residential and non-residential building-constructions and structures, crops, and trees, as well as permanent or tentative termination of business and employment, and physical resettlement.

The persons eligible for getting compensation within the framework of the project are:



All those who lose their lands towards which they possess ownership right or do not have a legal status, including the leaseholders, owners of other property attached to building, crops, plants, trees, or lands, leaseholders who have done improvements, and not registered users, persons who are subjected to the impact of losing business, income, and remuneration, and employees working in the business that will be exposed to the impact.

Kandazyan Styopa: he suggested video shooting the road section passing near Meghri in detail from the air, in particular, where it is going to bypass the customs checkpoint until Kajaran, and calculate the alienated land lots.

Response: currently the preliminary version of the project is under consultation, which is only an initial introduction to the works. In the coming phases, the lands impacted as a result of the final route will be defined, measurements will be done.

Kjalafyan Garik: he expressed his and the local population's concern and complaints regarding the alienation of lands of agricultural significance, adding that their main source of living is the cultivation of the presented land lots of agricultural significance. The alienation of the stated land lots may contribute to the outflow of the population, which is impermissible.

Response: for the section that will be particularly much impacted, where there are orchards and areas of agricultural significance, as the designer presented, preliminarily the most reasonable solution would be through overpasses or bridges.

Aslanyan Ishkhan – question: have the cartographers collaborated with the specialists from Meghri, who know the location better and will better understand the volume of the damage, and if they have not collaborated yet, why?

Response: the first phase of public hearings can be considered as the first approach of collaboration, which supposes recording of complaints, recommendations, and opinions, according to which the upcoming works will be proceeded.

Mikael Tevosyan: he stated that he was responsible on the environmental issues of the project. The works are in the first phase of expertise. The initial phase envisages making the local population aware of the intentions – awareness on the preliminary solutions of the route, recording of recommendations, after which, if possible, changes will be made, based on the technical conditions. Moreover, he presented data regarding the environmental works envisaged during the project implementation, further expertise phases and other planned public consultations.

During the public consultations, the participants presented their objections and recommendations in relation to the option of ensuring the bypassing of Meghri in order to exclude possible alienation of the land lots of agricultural significance and cultivated orchards, and suggested considering another option for the envisaged route in the given area.

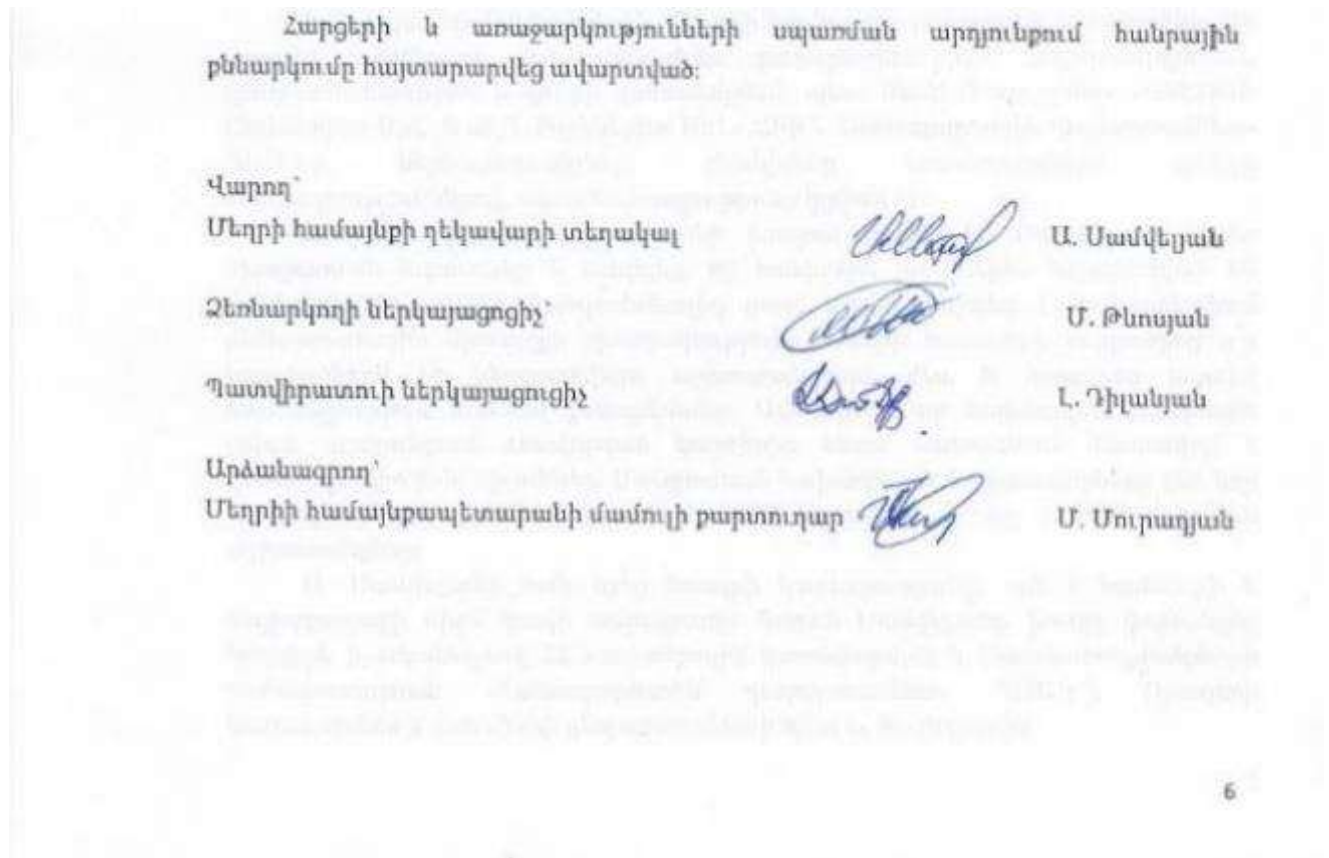
Response: the participants' recommendation will be considered by the designing organization and in the case if those suggestions are technically and economically efficient and grounded, respective changes will be made to the project design. In the meantime, it was stated that the project implementation was very



important for the development of Armenia and the implementing team would do their best to envisage technical solutions that would bring the adverse effects of the construction to the minimum, taking into consideration the justified request of the local population that there was a lack of lands and gardening was the only source of living for many of them.

The works of the envisaged project design will continue based on the technical conditions, considering the concerns, complaints and recommendations of the local population to the possible extent.

There being no further questions and suggestions the public consultation was called to an end.





03.06.2021, town of Kajaran





MINUTES

Kajaran

03.06.2021

The public consultation (second consultation) meeting regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program (NSRCIP), Tranche 4 was held on June 3, 2021, at 16:00 in the Municipality of the town of Kajaran, Syunik province, RA.

The meeting was attended by: representatives from the Municipality of Kajaran, “RD” SNCO (hereinafter referred to as RD), Center of Expertise for Environmental Impact Assessment SNCO (hereinafter referred to as SNCO), and IRD Engineering designing organization (hereinafter referred to as the Initiator) (the list of participants, along with their signatures and the recording are attached to the minutes).

The opening remarks were given by representative of the Municipality of the town of Kajaran, Head of the Department of Agriculture, Environment, Economic Development, and Programs Garegin Gabrielyan. He thanked everyone for their participation and stated that they were going to have the second consultation on the preliminary application for environmental impact assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program (NSRCIP), Tranche 4. He then invited the representative of the Initiator, M. Tevosyan to make his remarks.

M. Tevosyan introduced himself to the participants of the public consultation, and stated that all the respective specialists were present who would present the technical, environmental and social aspects of the project, as well as the procedure for the environmental impact assessment and expertise. He then gave the floor to the Initiator’s representative Andrea Bonci.

A. Bonci stated that they were having the second public consultations. He presented the technical aspect of the project in detail showing respective cartography materials. He presented the entire material in English, and his speech was translated into Armenian by M. Tevosyan.

RD Program Leader Karen Badalyan added to A. Bonci’s speech, presenting additional details, describing and showing on the map the connection with the envisaged road section of Sisian-Kajaran.

The Deputy Head of the community of Kajaran, Zohrap Arakelyan mentioned that the opening and operation of Meghrasar gold mine may take place in the areas surrounding the tunnel envisaged by the project, which also presupposes explosion works. He questioned on whether the works carried out in the mine would not pose serious risks for the building and operation of the tunnel.

A. Bonci and K. Badalyan said that the mentioned mine was going to be quite far from the tunnel and even if explosion works were carried out no issues would arise with ensuring safety, since the deepest spot of the construction of the tunnel will be 800 m, whilst the deepest spot in the mentioned area is 400 m.

Z. Arakelyan asked to clarify the entrance of the envisaged tunnel and to mention approximately the distance between the place planned for the dump and the tunnel entrance.

M. Tevosyan showed the mentioned sections on the map and made respective comments.



Z. Arakelyan stated that there were a burial ground and a cemetery in the areas surrounding the tunnel entrance of the presented route. He questioned on whether those areas had been considered by respective specialists.

M. Tevosyan mentioned that specialists with relevant qualifications had been hired for conducting those studies, which were in progress now throughout the entire territory of the route and the results of those studies would be summarized and presented in the EIA report.

The SNC representative, Heriknaz Mkrtchyan introduced herself and mentioned that all the expressed concerns and questions were being recorded and would be included in the technical assignment issued by the expertise center. She also mentioned that this was only the preliminary assessment phase and more detailed information would be available in the EIA report, which would be presented during the third public consultations.

A. Bonci concluded his remarks and mentioned that in some sections the road was going to cross the territory of “Arevik” National Park.

H. Mkrtchyan asked in which areas specifically the road was going to cross the territory of the national park.

M. Tevosyan stated that the preliminary information on that question was included in the preliminary assessment application; following respective studies, they would be included in the EIA report, and a more detailed and specific information would be provided in the attached cartography materials. He added that the initiator was closely collaborating with the representatives of “Zangezur” Biosphere Complex during the studies.

H. Mkrtchyan questioned whether it would be possible to make any layout/design changes in the final phase of the project if the studies showed that there were archaeological objects in the area which might appear in the impact zone.

M. Tevosyan mentioned that such questions were taken into consideration during the development of the project and he brought relevant examples of such instances. K. Badalyan added that the construction organization also carried out archaeological studies prior to starting the construction works. There is also a special process in place for ensuring the safety of accidental archaeological finds.

K. Badalyan described the advantages of the presented version of the route and explained why that particular version had been selected. He also mentioned that taking into consideration the landscape conditions of the area, the most optimal option had been selected.

H. Mkrtchyan asked whether there were not any serious risks present related to the surface water flows and which areas would be subjected to logging.

M. Tevosyan mentioned that no serious risks had been identified as a result of the preliminary studies, however, more detailed information would be available on that question after summarizing the results of the main studies, which would be included in the EIA report. He showed the main logging areas on maps, also mentioning that clear numbers and square meters would also be available upon completion of the respective studies.

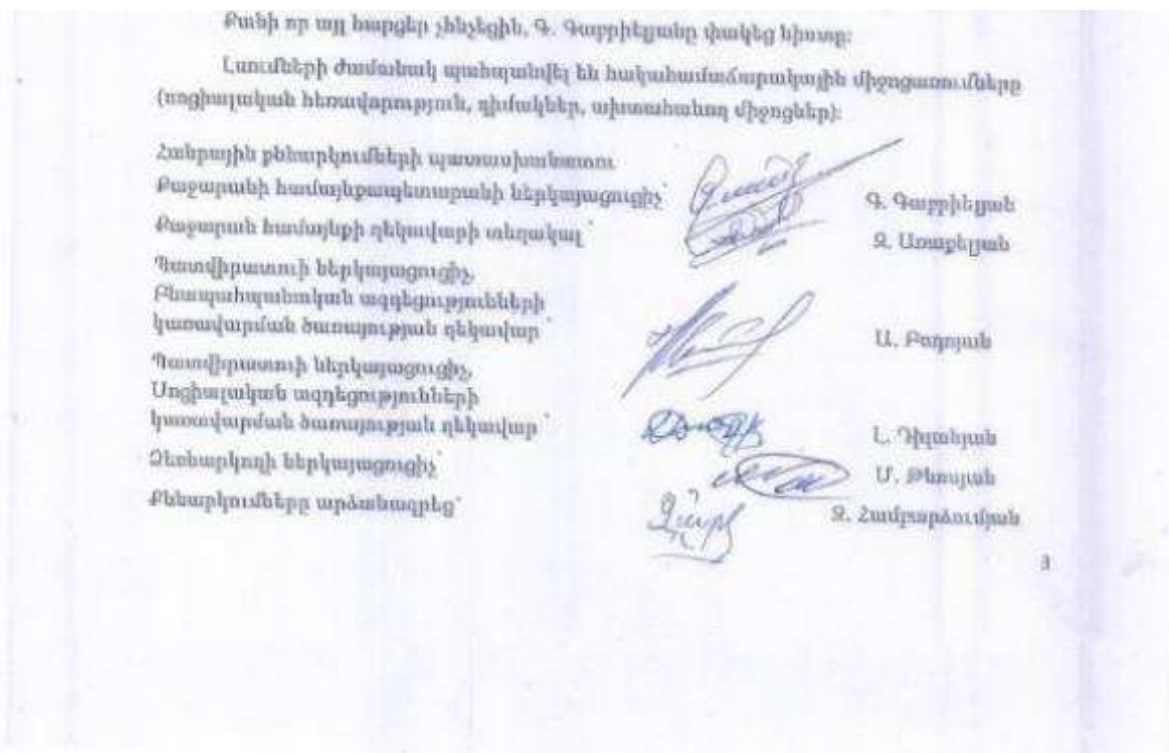


After A. Bonci’s remarks M. Tevosyan described the main environmental risks and their mitigation and elimination measures, also mentioning that active studies were in progress and that more detailed information would be provided during the third public consultations regarding the questions raised.

H. Mkrtchyan mentioned that the SNCO was conducting the expertise works of the presented project. He thoroughly described the environmental impact assessment and expertise procedure and noted that the initiator would be provided with a technical assignment based on the presented application, the opinions received and the questions raised during the public consultations based on which the EIA report of the presented project would be developed.

With no other questions asked G. Gabrielyan closed the meeting.

All the anti-epidemic measures (social distancing, masks, and disinfectants) were maintained during the hearings.





04.06.2021, town of Meghri



Minutes

Regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program, Tranche 4 (second consultation).



Meghri

04.06.2021

The second meeting of the public consultation (second consultation) regarding the environmental impact preliminary assessment on the Kajaran-Agarak road section project of the North-South road corridor investment program (NSRCIP), Tranche 4 was held on June 4, 2021, at 11:00 in the Municipality of Meghri, Syunik Province, RA.

The awareness about the public consultation was ensured by the official website of the Municipality, meghri.am, the Facebook page, “Republic of Armenia” daily newspaper, as well as bulletin boards.

The public consultation was run by Head of the Urban Construction, Land Use, Agriculture, and Property Management of the Municipality of Meghri, Syunik Province, RA, Mher Ghazaryan, jointly with the Deputy Team Leader of the Project consulting organization “IRD Engineering” and “J.P. Engineeria” JV, Andreas Bonci.

The meeting was attended by employees of different departments from the Municipality of Meghri, representatives from “IRD Engineering” SrL and “J. P. Engineeria” SrL JV (hereinafter referred to as the Initiator) and “Road Department” SNCO (hereinafter referred to as the RD), Center for Environmental Impact Expertise SNCO (hereinafter referred to as the SNCO), and local residents (the list of participants, along with their signatures and the video is attached).

The public consultation was opened by the welcoming remarks of M. Ghazaryan. He talked about the objective of the public consultation and said that the first consultation had been held according to the set order and that the community had given their preliminary consent. M. Ghazaryan added that the residents would like to hear the responses from the specialist involved in the public hearings regarding the questions and objections expressed during the first phase. He then gave the floor to the Initiator’s representative, Mikael Tevosyan.

M. Tevosyan introduced the participants of the public hearings, also informing that all the relevant specialists were in attendance who would present the technical, environmental and social aspects of the project, as well as the procedure for environmental impact assessment and expertise. He added that during the consultations, the project change results implemented as a result of the questions raised by the residents, and invited the Initiator’s representative Andre Bonci to make his remarks.

A. Bonci stated that the second public consultations were held. He presented the technical aspect in detail, showing the respective maps and materials. He presented the entire material in English, and his speech was translated into Armenian by M. Tevosyan.

During his speech, A. Bonci presented the following key information, showing all the marked information on the maps:

- The envisaged road will continue from the ending section of Sisian-Kajaran.
- Before the beginning of the town of Kajaran, the envisaged road will pass along the current M2 road (the road will be widened).
- Before reaching the town of Kajaran, the tunnel will start from the right bank of the river with a length of approximately 7.2 km.



- Before the entrance of the tunnel, two road blocks are envisaged in order to ensure the connection with the town of Kajaran and the village of Lernadzor.
- After the tunnel exit, the road will continue with the widening of the existing M2, and then going through some modifications (the details are presented in the cartography materials).
- It is envisaged to build road blocks near the villages of Vardanidzor and Lehvaz.
- The road will bypass the town of Meghri, after where two more road blocks are in the plans.
- Bridges, tunnels and other structures are envisaged to be constructed along the entire road.

A. Bonci presented the discussed version of the project changes, its advantages and disadvantages. He mentioned that the issues raised by the residents during the first consultation were taken into consideration and respective changes had been made, which significantly lowered the adverse effect caused with regard to obtaining lands. He also noted that the selected option was the most optimal one, considering the local landscape conditions of the area and people's suggestions.

Karen Badalyan added that the client had invested great resources for developing the presented project, so that the requests raised by the residents during the first public consultations were fulfilled.

Andrea Bonci continued his speech and mentioned that while making the change, the resident's interests had been taken into consideration and based on the technical requirements, the most possibly optimal option had been developed, which could meet all the requirements of the local residents. He added that the suggestions made by the residents had also been considered, consultations, studies had been conducted, based on which it had been possible to implement certain suggestions for the development of this version of the project. However, not all of them were implemented since they would simply not be viable.

After A. Bonci concluded his remarks M. Tevosyan presented the main environmental risks and their mitigation and elimination measures. He mentioned that currently a number of studies were in progress along the entire presented route, the results of which would be summarized in the EIA report and would be presented in more detail during the third public consultations. He added that the Initiator was also closely collaborating with the representatives of "Zangezur" Biosphere Complex for the purpose of assessing the risks in specially protected areas. He also stated that the presented project modifications had been made in the benefit of the residents.

SNCO representative Heriknaz Mkrtyan introduced herself and mentioned that all the raised concerns and issues were being recorded and would be included in the technical assignment issued by the center for expertise. She also stated that this was only the assessment phase and more detailed information would be available in the EIA report, which will be presented during the third public consultations. H. Mkrtyan added that the SNCO was conducted the expertise works of the presented project, described in detail the environmental impact assessment and expertise process and stated that the Initiator would be provided with a technical assignment based on the presented application and the questions and suggestions raised during the public consultations, based on which the EIA report of the presented project would be developed.

The following questions were raised after the specialists' remarks:



Question 1. Aharonyan Grenik: is it possible to show more specifically where the road is going to pass by and to provide the list of owners of the land lots which are going to be alienated?

The question was answered by L. Dilanyan, representative of RD, Head of Social Impact Management Service, stating that the list of owners was not extracted yet since the design works were not fully completed. She noted that this was a public hearing of an environmental field, organized for the purpose of learning about the environmental risks. It is necessary to have a final project to be able to extract the list of impacted lands through cadastral map, after which the list of owners of the lands to be impacted as a result of the project implementation would be ready. L. Dilanyan also mentioned that after the last public hearings, significant changes had been made to the project.

Question 2. Aharonyan Grenik: is it not possible to completely bypass the land lots?

L. Dilanyan noted that taking into consideration the local landscape and the technical requirements, it was not possible to completely bypass the mentioned land lots, however, considering the objections and suggestions made by the residents during the first public consultations, the most optimal version of the project had been developed.

K. Badalyan added that the layout of the road route had been developed in a way to affect the minimal number of land lots possible and to cause minimal inconvenience to the local population.

Question 3. Sergey Hayrapetyan: is it possible to calculate the distance of the residential area entering the town of Meghri on the points mentioned on the map, from one particular point, so we could understand which section the presented curved area was going to pass by.

K. Badalyan presented the curved area and made respective comments.

During the public consultations, the local residents presented their objections and suggestions in relation to excluding or minimizing the risks of possible alienation of land lots of agricultural significance.

There being no further questions and suggestions the public consultation was called to an end.



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12.08.2021, town of Kajaran





Minutes

*Kajaran**12.08.2021*

On August 12, at 16:00 pm, the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report (third public consultation) was held in the Municipality of Kajaran, Syunik Marz of the Republic of Armenia.

The representatives of Kajaran Municipality, "Road Department" SNCO (hereinafter referred to as "RD"), "IRD Engineering" and "DJP Engineering" design organization (hereinafter referred to as the Entrepreneur) were present, as well as representatives of zoological and botanical institutes and residents (list of participants with signatures and the video is attached to the protocol).

The opening speech was given by the representative of Kajaran community municipality, deputy head of the community Zohrap Arakelyan. He thanked everyone for being present, mentioned that today the third public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report will be held and passed the word to the representative of the Entrepreneur Mikael Tsosyan.

M. Tevosyan introduced the participants of the public consultation, mentioned that all the relevant specialists, who will present the technical, environmental and social parts of the program are present. He also mentioned that the specialists who conducted field research within the framework of this program and will present the results of the field research are present at these public consultation, then passed the speech to the representative of the Entrepreneur Andrea Bonchi.

A. Bonchi mentioned that the third public discussions will be held today, presented in detail the technical part of the project, showing relevant cartographic materials. He mentioned that the part passing through the territory of Kajaran community is mentioned as "Lot 2", and described especially in details the technical



solutions designed for that area (bridges, junction, tunnel, etc.). He noted that the construction of the presented large tunnel (about 7.5 km) will not hinder the local industrial activity, as well as the existing industrial processes that will not present any difficulties during the construction and operation of the tunnel. Then A. Bonchi summarized the technical solutions for the section from the entrance / exit of the tunnel to the Agarak city section ("Lot 1"). He highlighted the fact that the road was designed to have as little impact as possible, especially on Arevik National Park. A. Bonchi presented the whole material in English, and his speech was translated into Armenian by M. Tevosyan.

Vahe Hakobyan, a resident of Kajaran community, inquired what technical solutions (bridges, tunnels, etc.) are planned for the "Sisian-Kajaran" road section.

M. Tevosyan mentioned that "North-South road corridor investment program. Tranche 4 is divided into several sections, of which the Kajaran-Agarak road section, which starts near Lernadzor village, is part of the presented project, and Hovhannes Petrosyan, an engineer of the design company, presented the number of bridges, road equipment, tunnels, locations provided for "Lot 2" section.

M. Tevosyan summarized the works carried out within the framework of this project, mentioned that all the relevant components of the environment have been studied, appropriate measures have been developed to reduce the impact on them and to preserv them. He added that the presented materials are described in detail in the EIA report.

Z. Arakelyan asked to clearly show the "0" point of the program (in this case, "Lot 2"), that is, the beginning.

A. Bonchi and M. Tevosyan showed that point on the map and described the place.

Garegin Gabrielyan, the head of the agriculture, nature protection and economic development programs of Kajaran municipality, inquired in which specific sections and how much the existing M2 road should be widened.

H. Petrosyan mentioned the main technical requirements for the planned road, noting that in the sections where the current road will meet the requirements, only improvement works will be carried out in those sections, and the sections that do not meet the requirements will be widened.

G. Gabrielyan noted that the presented activity assumes the alienation of the lands, especially within the village of Lernadzor. He inquired how that process would be organized.

Lilit Dilanyan, Head of the Social Impact Management Service of "RD" SNCO, presented in detail the process related to land alienation. She also mentioned that separate public consultations will be organized in connection with social issues, to which all the owners, whose properties will be alienated, will be invited.

The representative of the Institute of Botany, botanist Merine Sargsyan introduced herself, mentioned that she had carried out a detailed study of the flora in the whole territory of the planned program. She summarized the results of the research, noting that only one species of red book plant was identified in the area of "Lot 2", which is not located directly in the area of the road plan, but is in the zone of influence of the plan. She noted that special measures have been developed to reduce the risk of this species, as well as the whole flora, which are presented in detail in the EIA report. M. Sargsyan briefly presented the types of trees of the presented area, as well as the main principles and mechanisms of tree planting.



G. Gabrielyan inquired how much topsoil is planned to be taken out during the works and how it is planned to be kept.

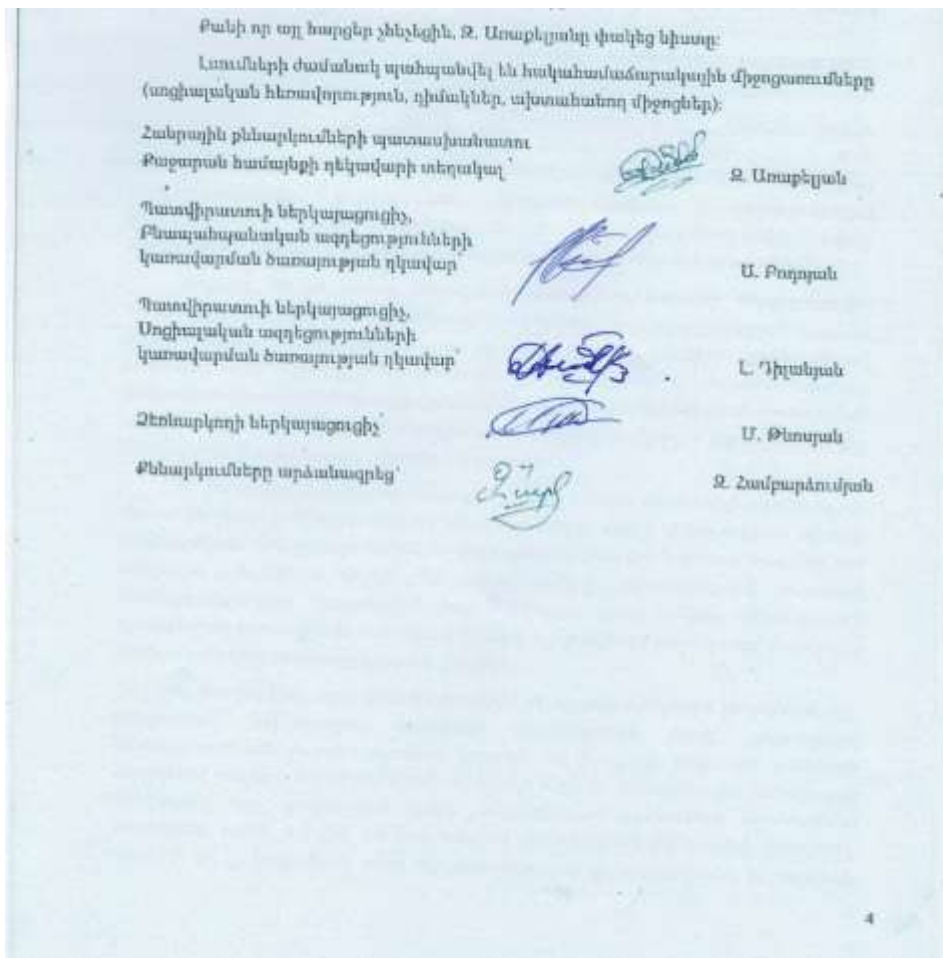
M. Tevosyan noted that there are clear calculations in the documents related to the amount of topsoil, and several options, which will be finally decided after negotiations with the community, are considered as storage sites.

Armen Bodoyan, Head of the Environmental Impact Management Service of "RD" SNCO, noted that the area of the closed tailing dump not far from Lernadzor village can be considered as a place for topsoil keeping.

The representative of the Institute of Zoology, zoologist Mamikon Ghasabyan introduced himself, mentioned that he had carried out a detailed study of the fauna in the whole area of the planned program. He summarized the results of the research, noting that no Red Book or endangered species of animals were identified in the area of "Lot 2", and the measures to mitigate the impact on animal species are presented in detail in the EIA report.

As no other questions were asked, Z. Arakelyan closed the consultation.

Anti-epidemic measures (social distance, masks, disinfectants) were kept during the consultation.





13.08.2021, ք. Մեղրի



Minutes

Meghri

13.08.2021



On August 13, at 11:00 am, the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report (third public consultation) was held in the Municipality of Meghri, Syunik Marz of the Republic of Armenia.

The representatives of Meghri Municipality, "Road Department" SNCO (hereinafter referred to as "RD"), "IRD Engineering" and "DJP Engineering" design organization (hereinafter referred to as the Entrepreneur) were present, as well as representatives of zoological, botanical and archeology and ethnography institutes and residents (list of participants with signatures and the video is attached to the protocol).

The opening speech was given by the representative of Kajaran community municipality, head of the community Ararat Tumanyan. He thanked everyone for being present, mentioned that today the third public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report will be held. He said that this program is very important for the Republic of Armenia, noting that the Meghri community is ready to support the initiators to implement the mentioned program unhindered and as soon as possible. Then passed the word to the representative of the Entrepreneur Mikael Tsosyan.

M. Tevosyan introduced the participants of the public consultation, mentioned that all the relevant specialists, who will present the technical, environmental and social parts of the program are present. He also mentioned that the specialists who conducted field research within the framework of this program and will present the results of the field research are present at these public consultation, then passed the speech to the representative of the Entrepreneur Andrea Bonchi.

A. Bonchi mentioned that the third public discussions will be held today, presented in detail the technical part of the project, showing relevant cartographic materials. He mentioned that the part passing through the territory of Meghri community is mentioned as "Lot 1", and described especially in details the technical solutions designed for that area (bridges, junction, tunnel, etc.). Then A. Bonchi summarized the technical solutions for the section from the entrance / exit of the tunnel to the Lernadzor village section ("Lot 2"). He highlighted the fact that the road was designed to have as little impact as possible, especially on Arevik National Park, as well as it will be built mainly on the currently operating M2 road project to minimize the alienation of lands and reduce environmental impacts. A. Bonchi presented the whole material in English, and his speech was translated into Armenian by M. Tevosyan.

The residents wondered why it was not possible to design the whole road along the existing M2 road.

A. Bonchi and Hovhannes Petrosyan, an engineer from the design company, said that there are clear technical requirements for the construction of a new road (for example, providing appropriate slopes, reducing curves, etc.), which the current M2 does not comply with in some sections, so other technical solutions have been provided for that sections.

The residents inquired about the standards by which the presented new road plan was designed and what legislative requirements were taken into account.

H. Petrosyan noted that first of all the legislative requirements of the Republic of Armenia and standards, as well as all relevant international standards and principles were taken into account.

The residents asked to clarify the locations of the planned road junctions near the settlements.

A. Bonchi showed the location of all the planned road junctions on the map and gave relevant comments.



Some of the residents asked to show more specifically on the map the areas that will appear in the project impact zone and will be subject to alienation.

A. Bonchi and H. Petrosyan showed all the mentioned areas and gave relevant comments.

The participants inquired in which specific sections and how much the existing M2 road should be widened.

H. Petrosyan mentioned the main technical requirements for the planned road, noting that in the sections where the current road will meet the requirements, only improvement works will be carried out in those sections, and the sections that do not meet the requirements will be widened.

M. Tevosyan summarized the A. Bonchi's and H. Petrosyan's speech and passed the word to the group of specialists who conducted field research.

The representative of the Institute of Botany, botanist Merine Sargsyan introduced herself, mentioned that she had carried out a detailed study of the flora in the whole territory of the planned program. She summarized the results of the research, noting that several plant species in need of protection have been identified in the area of "Lot 1", for which special protection measures have been developed. She noted that special measures have been developed to reduce the risk of the whole flora, which are presented in detail in the EIA report. M. Sargsyan briefly presented the types of trees of the presented area, as well as the main principles and mechanisms of tree planting and noted that during the implementation of these works, the implementer will cooperate with the local plantations.

M. Tevosyan added that replanting of trees will be done in a ratio of 1:2 for common species and 1:10 for endangered or specially protected species.

The representative of the Institute of Zoology, zoologist Mamikon Ghasabyan introduced himself, mentioned that he had carried out a detailed study of the fauna in the whole area of the planned program. He summarized the results of the research in the area of "Lot 2" and noted that the measures to mitigate the impact on animal species are presented in detail in the EIA report. He mentioned that during the implementation of the program, reptiles are mainly vulnerable. To solve this problem, the construction company will be offered to hire a reptile specialist, who will organize the reptile protection mechanisms on the site.

Representative of the Institute of Archeology and Ethnography, archeologist Hayk Haydosyan mentioned that their professional group carried out a detailed study of objects of historical and cultural value in the entire area of the planned project. He summarized the results of the researches carried out in the territory of "Lot 1", mentioned that the areas near the impact zone of the program implementation were also studied. He presented some natural monuments, which will not be affected by the implementation of the impact plan, but are located near the area, noting that appropriate measures have been proposed to protect these monuments and reduce the impact risks, which are presented in detail in the EIA report.

The residents inquired how the natural monuments would be preserved, for example, during the blasting works.

H. Haydosyan, archeologist Ani Adygyozalyan, as well as Armen Bodoyan, head of the environmental impact management service of "RD" SNCO, gave relevant comments.



M. Tevosyan summed up the speech of the specialists who conducted field research and passed the word to Lilit Dilanyan, the head of the social impact management service of "RD" SNCO.

L. Dilanyan introduced herself and mentioned that "RD" SNCO is the organization implementing this program. She presented in detail all the social risks and problems, legislative requirements in the Republic of Armenia and regulations related to land alienation and compensation, as well as the international experience of "land alienation and resettlement policy", which will be used as a principle during the implementation of the presented program (taking into account requirements of the project financing organization). L. Dilanyan noted that for the solution of social problems separate public consultations will be organized, to which all the owners whose properties will appear in the zone of influence will be invited and after those consultations the relevant process will start, guided by the above-mentioned regulations. She presented in detail the stages of the land alienation process, the rights of residents (owners or tenants), as well as the main legal requirements governing the process.

The residents inquired whether the state would expropriate all the property of the owner if the program affected not all of the property but half or some part of it.

L. Dilanyan mentioned that when a part of the owner's property is affected (partial alienation), the law envisages two main principles of alienation of the whole property. She presented those principles and the order of the process.

The residents inquired how the problem of infrastructure (irrigation water, electricity, etc.) and access roads would be settled.

L. Dilanyan noted that the project envisages mechanisms for providing all types of infrastructure to ensure the comfort of residents, as well as the construction or repair of access (secondary) roads to provide access to the property of the resident.

The residents inquired when public consultations would be organized to carry out a more detailed analysis of social issues.

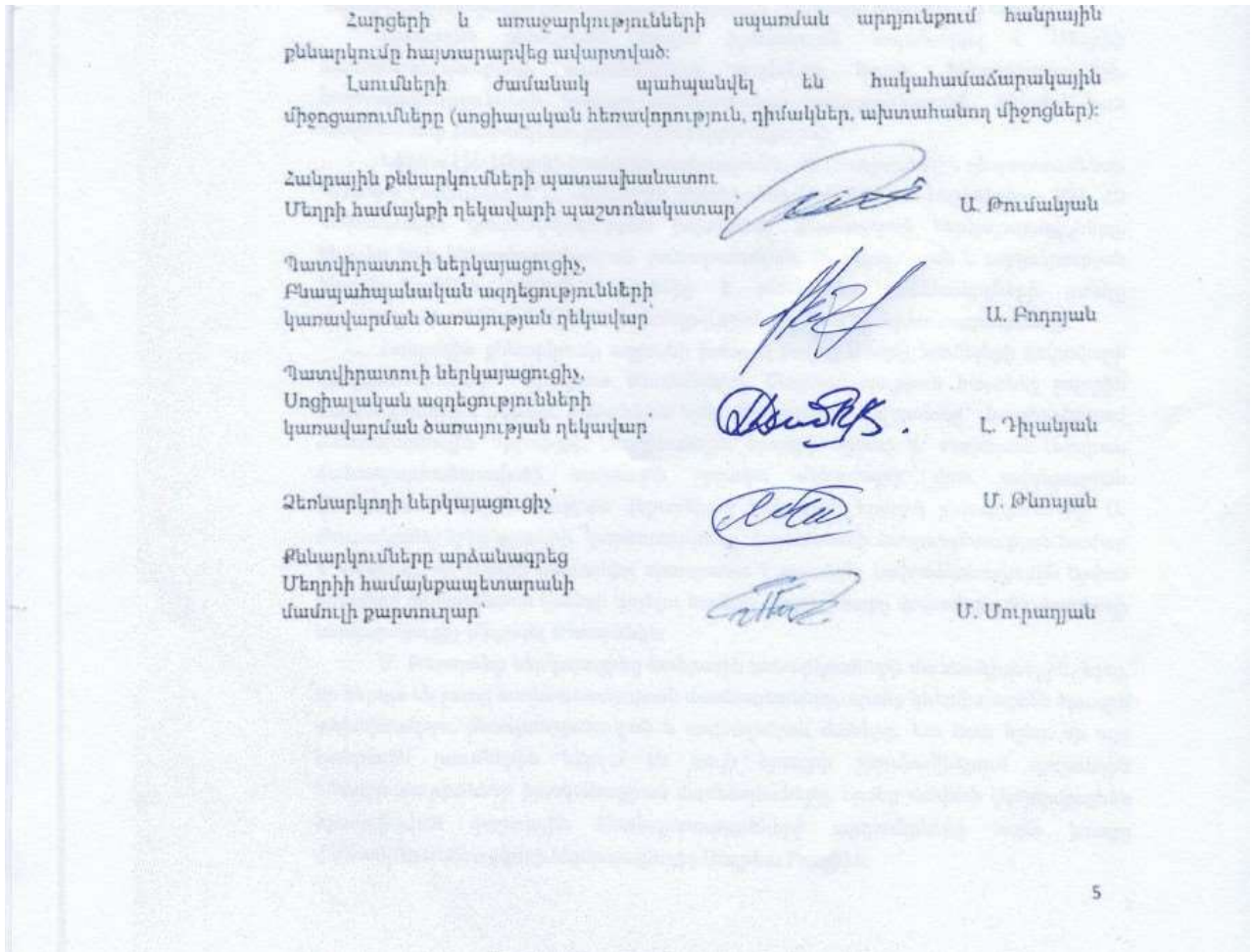
L. Dilanyan noted that they have already applied to the Cadastre Committee of the Republic of Armenia to receive clear information and the mentioned public consultations will be organized within about 15 days, which will be held not only in the municipality, but in all settlements.

Participants asked L. Dilanyan to present the principles of compensation implemented in the process of land alienation.

L. Dilanyan presented in detail the principles of compensation and some general points of the methodology.

As no other questions were asked, A. Tumanyan closed the consultation.

Anti-epidemic measures (social distance, masks, disinfectants) were kept during the consultation.



17.01.2022, town of Kajaran



Minutes

Of the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report (fourth public consultation).



Kajaran

17.01.2022

On January 12, at 16:00 pm, the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report (fourth public consultation) was held in the Municipality of Kajaran, Syunik Marz of the Republic of Armenia.

The representatives of Kajaran Municipality, "Road Department" SNCO (hereinafter referred to as "RD"), "IRD Engineering" and "DJP Engineering" design organization (hereinafter referred to as the Entrepreneur), "Environmental Impact Assessment Center" SNCO of the RA Ministry of Environment (hereinafter referred to as SNCO) and residents were present (list of participants with signatures and the video is attached to the protocol).

The opening speech was given by the representative of Kajaran community municipality, deputy head of the community Zohrap Arakelyan. He thanked everyone for being present, mentioned that today the fourth public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report will be held and passed the word to the representative of the Entrepreneur Mikael Tsosyan.

M. Tevosyan introduced the participants of the public consultations, mentioned that the fourth public consultations are being held, during which the materials presented at the previous public consultations will be summarized and the questions and suggestions raised by the community will be recorded. Then he passed the word to the representative of the design organization Karen Arakelyan.

K. Arakelyan summarized the project solutions, that are in the Project, mentioned that the suggestions and remarks raised by the community were taken into account during the design stage. Then he passed the word to the representative of the SNCO Heriknaz Mkrtchyan.

H. Mkrtchyan noted that she was carrying out the expertise of the submitted Project, presented in detail the expertise process defined by the RA law, said that the EIA report was provided to all relevant ministries, as well as departments of the Ministry of Environment, from which opinions on the report were received and the EIA report has been amended. She also presented in detail the structure of the EIA report and noted that the opinions and suggestions expressed during this public consultation will also be taken into account.

Then M. Tevosyan summarized the environmental measures described in the EIA report, adding that the Construction Contractor will work closely with the community before carrying out any construction work.

H. Mkrtchyan suggested clearly coordinate with the community in the filed of the areas necessary for tree planting, landfills and plant soil protection.

M. Tevosyan noted that all the agreements are reached with the community and are presented in the relevant section of the EIA report.

The discussion among participants about tree felling, tree planting, the areas needed for them, as well as the care work to be carried out by the Construction Contractor was held.

M. Tevosyan and the representative of the Customer Armen Bodoyan gave relevant comments, quoting the relevant legal regulations and presenting different examples. M. Tevosyan also added that within the framework of elaborating the EIA report, the Entrepreneur cooperated with the representatives of "Arevik" National Park. A. Bodoyan also explained in detail the issues related to the change of the land category.



Garegin Gabrielyan, Head of the Department of Nature Protection, Agriculture and Economic Development Programs of Kajaran Municipality, inquired how the care of the newly planted trees will be carried out, in particular, the irrigation.

K. Arakelyan mentioned that the irrigation system is not envisaged in the design package, but the Construction Contractor will be obliged to provide proper irrigation and he described the possible irrigation options. A. Bodoyan summed up the speech with examples.

The participants presented some possible problems that may arise during tree planting, in particular during their care and other works and were interested in how those problems will be solved.

A. Bodoyan mentioned that both the community and the Customer will follow the presented works and there will be clear requirements that the Construction Contractor must fulfill. He noted that in case of registration of problems, the Construction Contractor will be required to take appropriate measures to eliminate that problems. A. Bodoyan described the three-level control system and summed up his speech with examples. He emphasized the fact that, first of all, the community itself is the supervisor of the construction works and it must be very consistent in the implementation of the Project.

M. Tevosyan added that all the detailed studies envisaged for the given stage (historical-cultural, zoological, botanical, etc.) have been carried out and the results are presented in the relevant sections and appendices of the EIA report. He noted that the revised EIA report has been provided to the community and all interested parties can study it.

H. Mkrtychyan inquired what kind of research had been carried out in the area intended for tree planting.

M. Tevosyan noted that all relevant studies typical of this stage have been carried out and the results have been presented in the EIA report. He added that a detailed environmental management plan for the site presented by the Construction Contractor will contain detailed information about that issue.

Discussions were held about the deforestation in private areas and the participants were interested in the principle of organizing that process.

M. Tevosyan and A. Bodoyan mentioned that after the alienation, the property becomes state-owned, which is then provided by the state to the community; the future management of the property already depends on the community. A. Bodoyan added that the compensation for the alienated property will be organized very consistently, it is carried out in such a way that people can acquire appropriate property instead of the alienated one.

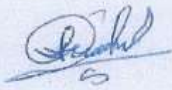
As no other questions were asked, Z. Arakelyan closed the consultation.

Anti-epidemic measures (social distance, masks, disinfectants) were kept during the consultation.





Քանի որ այլ հարցեր չհնչեցին, Ջ. Առաքելյանը փակեց նիստը:

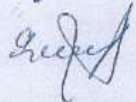
Լսումների ժամանակ պահպանվել են հակահամաճարակային միջոցառումները (սոցիալական հեռավորություն, դիմակներ, ախտահանող միջոցներ):

Հանրային քննարկումների պատասխանատու
Քաջարան համայնքի ղեկավարի տեղակալ՝  Ջ. Առաքելյան

3

Պատվիրատուի ներկայացուցիչ,
Բնապահպանական ազդեցությունների
կառավարման ծառայության ղեկավար  Ա. Բորոյան

Ձեռնարկողի ներկայացուցիչ՝  Մ. Թևոյան

Քննարկումները արձանագրեց՝  Ջ. Համբարձումյան

18.01.2022, town of Meghri



Minutes

Of the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project’s Environmental Impact Assessment Report (fourth public consultation).

18.01.2022

C. Meghri



On January 18, at 11:00 am, the public consultation on North-South Road Corridor Investment Program, Tranche 4. The Kajaran-Agarak Road Section Project's Environmental Impact Assessment Report (fourth public consultation) was held in the Municipality of Meghri, Syunik Marz of the Republic of Armenia.

Informing about the public consultations was carried out through the official website of the municipality meghri.am, Facebook page, Hayastani Hanrapetutyun daily newspaper, as well as through the bulletin board.

The representatives of Meghri Municipality, "Road Department" SNCO (hereinafter referred to as "RD"), "IRD Engineering" and "DJP Engineering" design organization (hereinafter referred to as the Entrepreneur), "Environmental Impact Assessment Center" SNCO of the RA Ministry of Environment (hereinafter referred to as SNCO) and residents were present (list of participants with signatures and the video is attached to the protocol).

The head of Meghri community Bagrat Zakaryan said the opening speech. He thanked everyone for being present, noting that the fourth public discussion on the Environmental Impact Assessment Report for the North-South Road Corridor Investment Program Tranche 4. Kajaran-Agarak Road Project will be held today. He said that this program is very important for the Republic of Armenia, noting that the Meghri community is ready to support the initiators to implement the mentioned Project unhindered. Then he passed the word to the representative of the Entrepreneur Mikael Tsosyan.

M. Tevosyan introduced the participants of the public consultations, mentioned that the fourth public consultations are being held, during which the materials presented at the previous public consultations will be summarized and the questions and suggestions raised by the community will be recorded. He added that all the suggestions voiced by the participants during the consultations were taken into account as much as possible and during these public discussion all the suggestions and remarks will be recorded as well and will be taken into account. Then he passed the word to the representative of the design organization Karen Arakelyan.

K. Arakelyan summarized the project solutions, that are in the Project, mentioned that the suggestions and remarks raised by the community were taken into account during the design stage. He noted that after the previous public consultations, no design changes were made, but there were some additions and reductions due to the requirements presented by the community. K. Arakelyan also presented the issues related to land alienation.

The residents inquired about the period during which the process of valuing the alienated property will be carried out.

The Customer's representative Armen Bodoyan presented in detail the procedure for assessing the property to be alienated and the schedule.

The participants inquired about the procedure for valuing the alienated property and what compensation they would receive.

A. Bodoyan, H. Petrosyan and K. Arakelyan described in detail the assessment of the alienated property, the compensation processes, mentioned that meetings would be held with all the affected residents, and appropriate agreements would be reached before the alienation of the property.



The residents mentioned that measurements were carried out by some of the owners by the social team. They inquired whether they would be compensated for the property that would be added to the area after the measurement.

A. Bodoyan և H. Petrosyan mentioned that from the moment when the final measurements will be made and the owner will give his consent in the form of a signature, he/she will not be compensated for the additional added property. As a result of the discussions, it turned out that the final measurements were not carried out, but preliminary inspections were carried out by the relevant professional team.

H. Mkrtchyan noted that she was carrying out the expertise of the submitted Project, presented in detail the expertise process defined by the RA law, said that the EIA report was provided to all relevant ministries, as well as departments of the Ministry of Environment, from which opinions on the report were received and the EIA report has been amended. She also presented in detail the structure of the EIA report and noted that the opinions and suggestions expressed during this public consultation will also be taken into account.

Yervand Meliksetyan, a resident of Meghri community, mentioned that one of the planned tunnels (Meghri, Pokr Tagh section) is very close to the church and a number of houses that are in bad condition may be damaged.

H. Petrosyan noted that before the finalization of the project, relevant researches were carried out and it was revealed that the construction of the tunnel would not damage the adjacent buildings or the church. He added that in case of any damage, the owner will definitely be compensated, in addition the regular monitoring works will be carried out, as well as if large risks will be revealed, the construction works will be stopped until appropriate solutions are found. A. Bodoyan added that before the beginning of the construction works, additional studies will be carried out by the Construction Contractor.

The residents inquired whether the compensation received in case of alienation of the property would be enough for the owner to restore the same property in another place.

A. Bodoyan and K. Arakelyan mentioned that it is one of the principles of compensation and the owner receives such compensation, which will allow him to fully restore the property alienated from him.

One of the residents mentioned that the road plan does not cross his property, but it was also considered an alienation zone, he asked the specialists to clarify that issue.

H. Petrosyan mentioned that in addition to the road, infrastructures will be built, for which space is also needed, he mentioned that for that reason, alienation of land can also take place.

Residents inquired whether soundproofing barriers were designed to mitigate the negative impact on animals during construction.

M. Tevosyan noted that appropriate measures have been developed to mitigate the impact on biodiversity, based on detailed research, during which the areas of "Arevik" National Park were studied, as a result of which the need for such a protective measure was not revealed.

Arsen Margaryan, the founder of "Mkhitar Sparapet" environmental non-governmental organization, inquired whether the radioactive background was not high in the given region, whether it would not cause any problems for the construction of the road.



A. Bodoyan mentioned that there are large contents of lead in the given region, but the general radioactive background is quite low, which does not cause any risk.

H. Mkrtchyan inquired how many trees are planned to be planted and in which settlements.

M. Tevosyan noted that preliminary agreements have been reached with the community on the planting areas and are included in the EIA report, and more detailed information will be available in the site-specific environmental management plan prior to the commencement of construction work.

The residents inquired how the timber or construction material of the alienated areas will be managed.

M. Tevosyan and A. Bodoyan mentioned that after the alienation, the property becomes state-owned, which is then provided by the state to the community and the future management of the property already depends on the community.

B. Zakaryan asked to present the principles of partial alienation.

A. Bodoyan gave relevant comments, noting that partial alienation takes place only in case of land alienation, he noted that the buildings will be alienated completely.

A. Margaryan mentioned that it is possible that monuments of historical and cultural value will appear during the construction works and inquired what processes are planned for those cases.

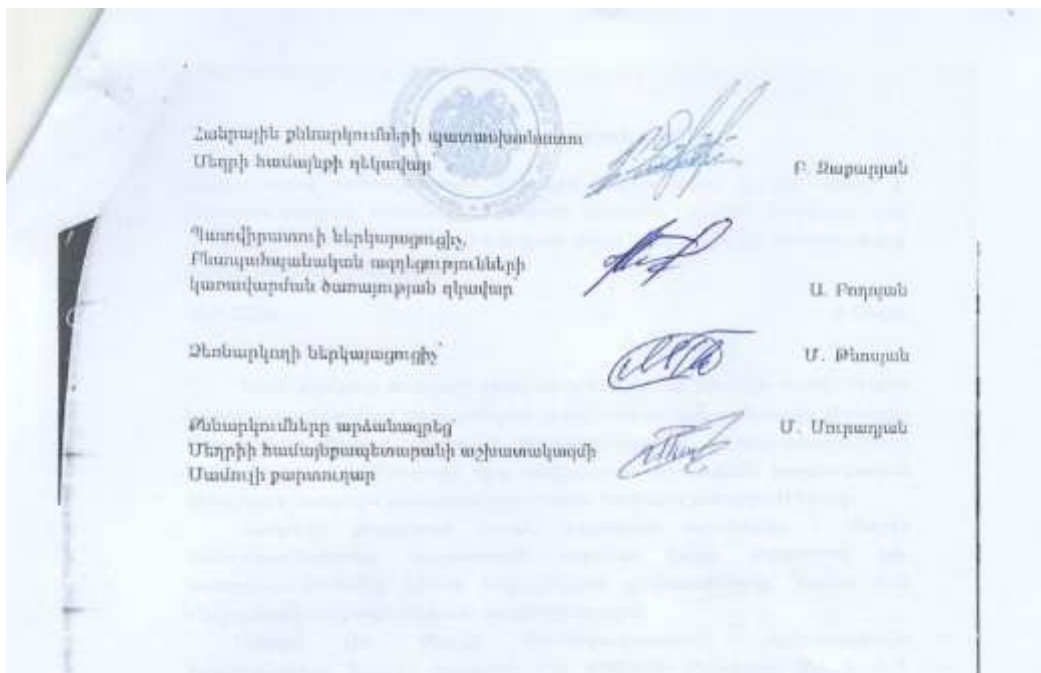
M. Tevosyan and A. Bodoyan mentioned that the process of "chance finding" has been developed for such cases and presented in detail the principles of that process.

The participants also inquired whether the illegal property was subject to compensation.

A. Bodoyan mentioned that besides the land, any other illegal property is also subject to compensation.

As no other questions were asked, B. Zakaryan closed the consultation.

Anti-epidemic measures (social distance, masks, disinfectants) were kept during the consultation.





ANNEX 12: LETTERS AND WRITINGS SENTED TO THE MINES

Below are presented the letters and writings sended to "Zangezur Copper and Molybdenum Combine" CJSC and "SIPAN-1" LLC.



Contract T4-CS-01-D : Preparation of Detailed Design, Land Acquisition and Reallocation Plan and Implementation of Author Supervision of about 32 km road from Agarak to barrel exit, and Preparation of Detailed Design, Land Acquisition and Reallocation Plan of about 7 km road from barrel entrance to Qajaran and about 6 km of the barrel and access roads (Tranche 4)

10/02/2021
Ref: IRD21-PO001-A

10/02/2021
Ref: IRD21-PO001-A

To: Zangezur Copper and Molybdenum Combine CJSC
Lernagorchneri str. 18, Syunik Marz
3309 Kajaran, Armenia

Հասցեագրված է՝
«Հանգեզուրի պղնձամոլիբդենային կոմբինատ» ՓԲԸ
Լեռնագործների փ. 18, Այունիքի մարզ
3309 Քաջարան, ՀՀ

Attn. General Director

Գլխավոր տնօրեն՝

CC. Mr. Karen Badalyan
Project Manager Road Department
Armenia

Պատճեններ՝ Ծրագրի ղեկավար,
Ճանապարհային ղեկավարամենտ, ՀՀ
պրն. Կարեն Բադալյանին

Contract: T4-CS-01-D, Qajaran/Agarak
(Tranche 4)

Պայմանագիր՝ T4-CS-01-D,
Քաջարան/Ագարակ (Տրանշ 4)

Reference: N/A

Հղում՝ N/A

Subject: Clearance verification

Թեմա՝ Անվտանգ հեռավորության
ճշգրտում

Dear All,

According to Contract N T4-CS-01-D signed with the Road Department of Armenia SNCO acting on behalf of the Ministry of Territorial Administration and Infrastructure of Republic of Armenia, IRD Engineering S.R.L in JV with GP Ingegneria S.R.L prepared the Preliminary Design of the new road from Kajaran to Agarak, including a new tunnel running close to the mining area and the improved realignment of the existing road, and is now preparing the relevant detailed design.

While expecting the new road will boost the national and local economy, being part

Հարգելի գործընկերներ,

Համաձայն ՀՀ Տարածքային կառավարման և ենթակառուցվածքների նախարարության անունից գործող «Ճանապարհային ղեկավարամենտ» ՊՈԱԿ-ի հետ կնքված թիվ T4-CS-01-D պայմանագրի՝ «ԱՅԵՐԻԻՒ Ելցինիրիկ» ՍՊԸ և «ՋԻՓԻ Ինջեներիա» ՍՊԸ ՀԶ-ն պատրաստել է Քաջարան-Ագարակ նոր ճանապարհի Լախնական նախագիծը. նախագիծը ներառում է նոր բունել, որն անցնում է հանքի հարակից տարածքով, և գոյություն ունեցող ճանապարհի ծրագրի բարելավում: Այժմ մշակվում է համապատասխան Մանրամասն նախագիծը:

Անկեղծվում է, որ նոր ճանապարհը, հանդիսանալով Հայաստանի Հյուսիս-Հարավ ճանապարհային միջանցքի մասն և

Joint Venture: IRD ENGINEERING - GPINGGNERIA
Office Address - Elite Plaza Business Center - 0019, 15 Movses Khorenatsi Street, Yerevan, Armenia





Contract T4-CS-02-D : Design for Gajaran-Aganak road (Tranche 4)

of the North-South Armenian corridor and providing a safe, reliable and fast connection to the most southern area of the country, we are aware that there might be interference between the road and the mining activities.

With reference to the project and the reasons above, we kindly ask you to provide us with the contour of the area under exploitation and of the area granted with mining permit/ concession for the due clearance verification

At the same time we would appreciate your availability to have a meeting in Kajaran to present the project and examine together any constraint or opportunity for improvement connected to your activity.

A map with the preliminary alignment of the new tunnel (green line) is attached for your convenience.

Yours faithfully,

Paolo Orsini
Team Leader and IRD Managing Director

Հարգանքով՝

Պաուլո Օրսինի
Թիմի ղեկավար և
Այ. Ար. Դի. Էնջինի ըրինգ Ս.ր.լ.
Գլխավոր տնօրեն

Attachments:

- Map and profile of the Tunnel area

Կից փաստաթղթեր՝

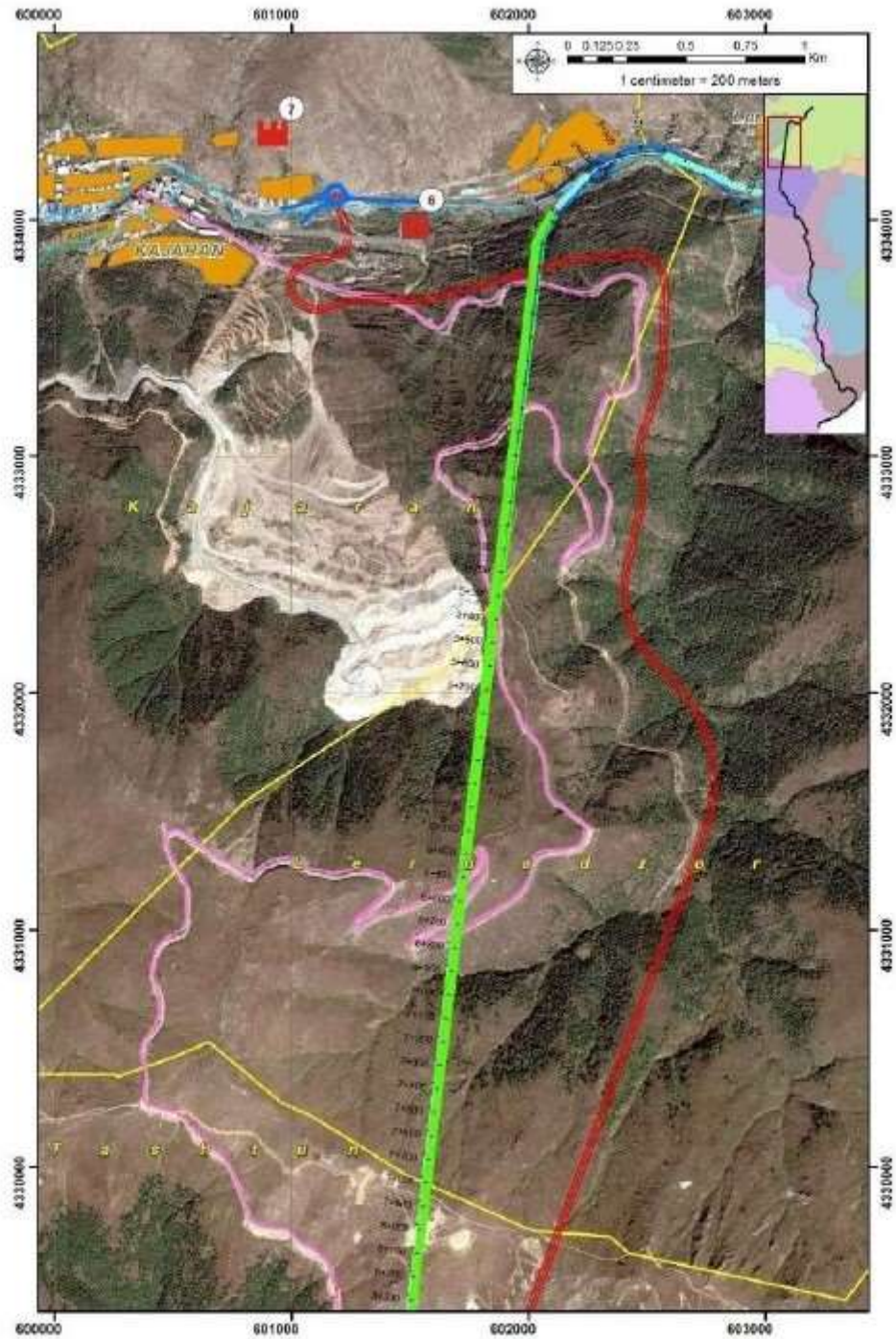
- Քարտեզ և թունելի տարածքի երկայնական կտրվածք

Joint Venture IRD ENGINEERING - GPINGEGNERIA
Office Address - Elite Plaza Business Center - 0010, 15 Movses Khorenatsi Street, Yerevan, Armenia



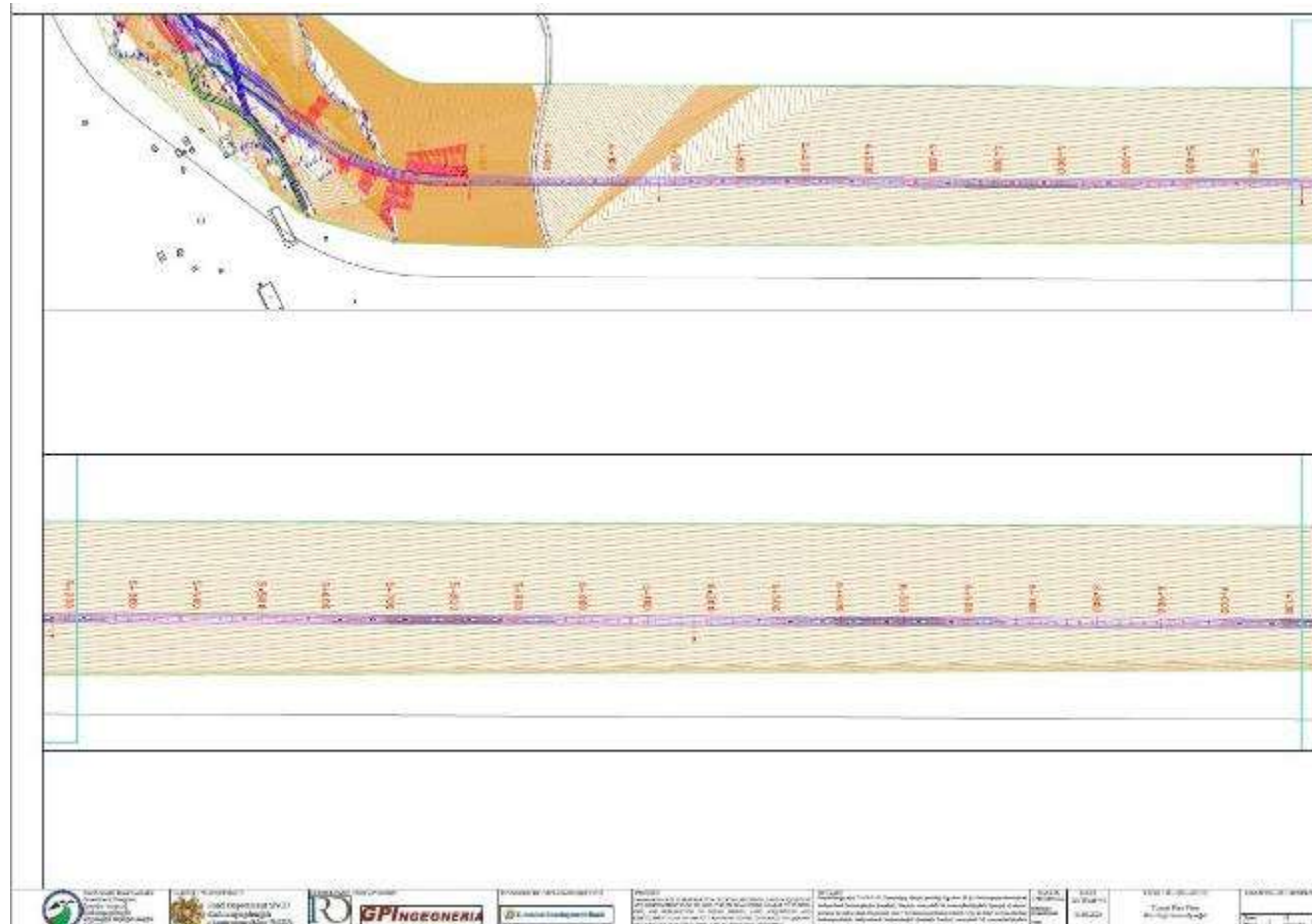


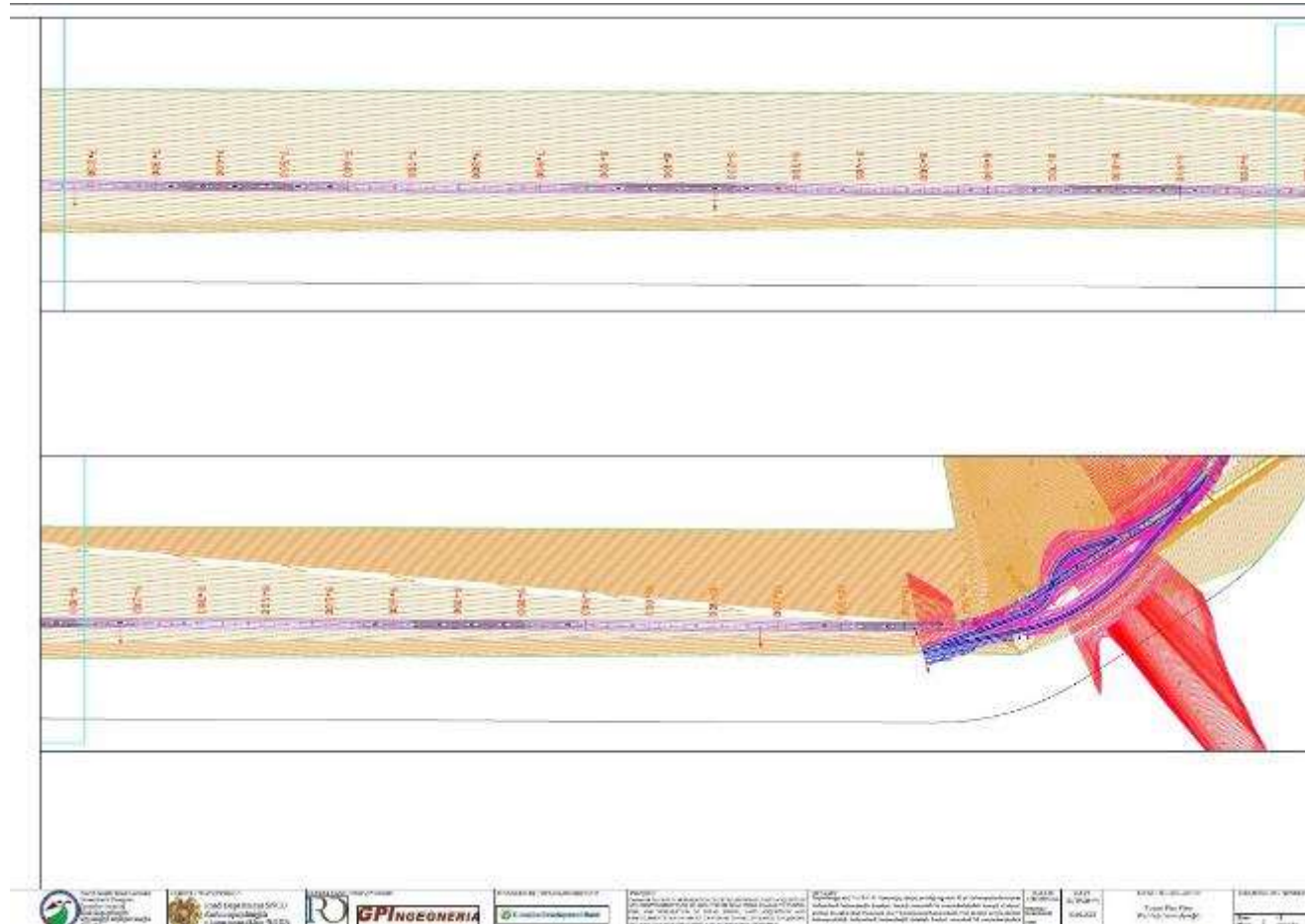
Contract T4-CS-01-D : Design for Qajaran-Agarak road (Tranche 4)

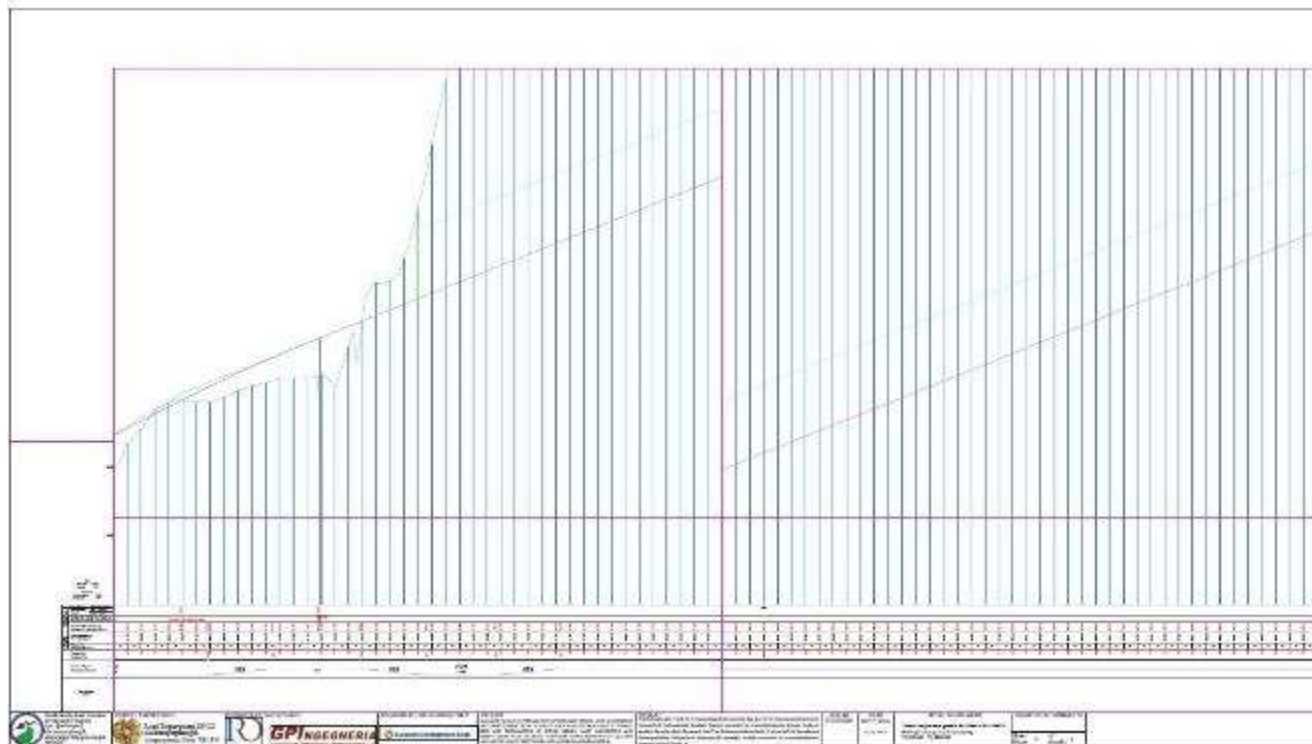


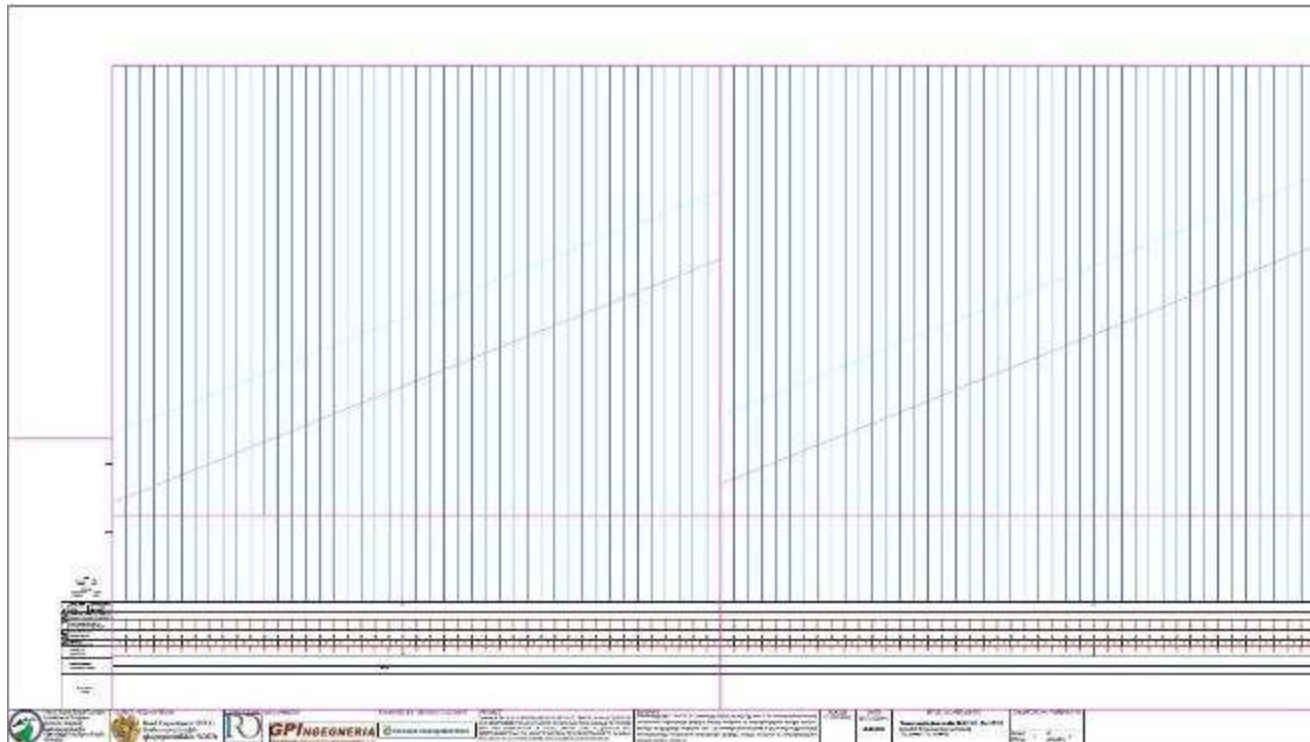
Joint Venture IRD ENGINEERING - GPINGENNERIA
Office Address - Elite Plaza Business Center - 0010, 15 Movses Khorenatsi Street, Yerevan, Armenia

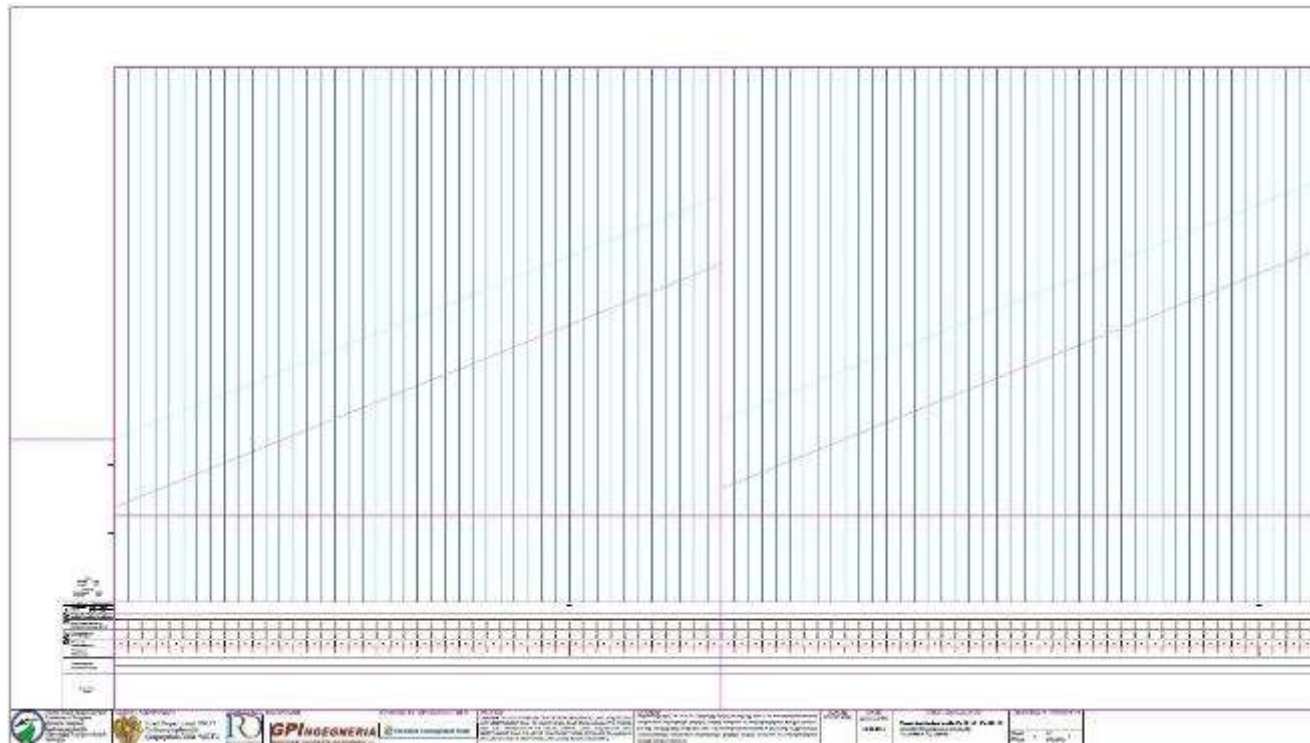


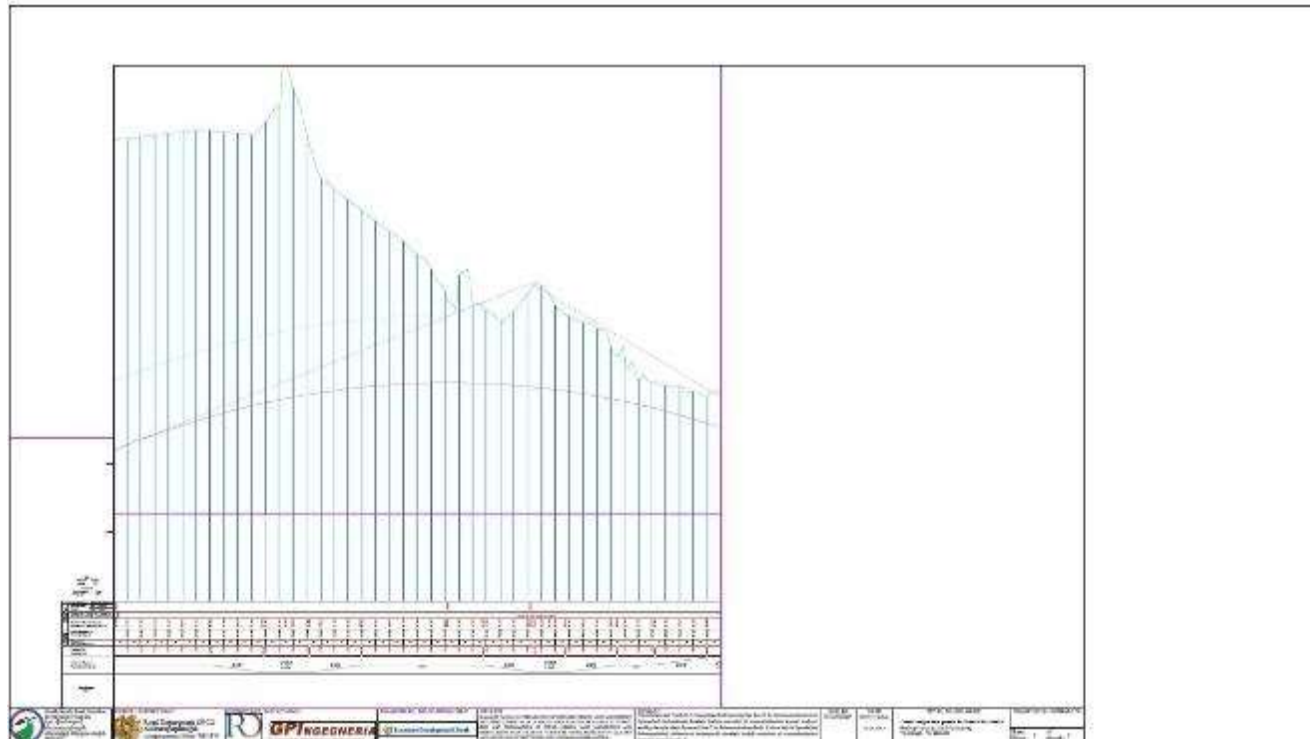














Contract T4-CS-01-D : Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

05/03/2021
Ref: IRD21-PO005-A

05/03/2021
Ref: IRD21-PO005-A

To: "SIPAN 1" LLC
Village Aygedzor, Syunik Region, RA

Հասցեագրված է՝ «ՍԻՓԱՆ-1» ՍՊԸ
ՀՀ, Սյունիքի մարզ, գ Այգեծոր

Attn. Ms. Silva Hambardzumyan
CEO

Գլխավոր գործադիր տնօրեն՝
Սիլվա Համբարձումյանին

CC. *Mr. Karen Badalyan*
Project Manager Road Department
Armenia

Պատճենը՝ Ծրագրի ղեկավար,
Ճանապարհային ղեկարտամենտ, ՀՀ
պրն. Կարեն Բադալյանին

Contract: T4-CS-01-D, Qajaran/Agarak
(Tranche 4)

Պայմանագիր՝ T4-CS-01-D,
Քաջարան/Ագարակ (Տրանշ 4)

Reference: N/A

Հղում՝ N/A

Subject Clearance verification

Թեմա՝ Անվտանգ հեռավորության
ճշգրտում

Dear All,

According to Contract N T4-CS-01-D signed with the Road Department of Armenia SNCO acting on behalf of the Ministry of Territorial Administration and Infrastructure of Republic of Armenia, IRD Engineering S.R.L in JV with GP Ingegneria S.R.L prepared the Preliminary Design of the new road from Kajaran to Agarak close to the mining area of your interest and is now preparing the relevant detailed design.

While expecting the new road will boost the national and local economy, being part of the North-South Armenian corridor and providing a safe, reliable and fast connection to the most southern area of the country, we are aware that there might be interference between the road and the

Հարգելի գործընկերներ,

Համաձայն ՀՀ Տարածքային կառավարման և ենթակառուցվածքների նախարարության անունից գործող «Ճանապարհային ղեկարտամենտ» ՊՈԱԿ-ի հետ կնքված թիվ T4-CS-01-D պայմանագրի՝ «ԱՅԵՌԴԻ Էնջինիրինգ» ՍՊԸ և «ՋԻՓԻ Ինջիներիա» ՍՊԸ ՀԶ-ն պատրաստել է Քաջարան-Ագարակ նոր ճանապարհի նախնական նախագիծը, որն անցնում է հանրի հարակից տարածքով: Այժմ մշակվում է համապատասխան մանրամասն նախագիծը:

Ակնկալվում է, որ նոր ճանապարհը, հանդիսանալով Հայաստանի Հյուսիս-Հարավ ճանապարհային միջանցքի մաս և ապահովելով անվտանգ, հուսալի և արագ կապ երկրի ամենահարավային շրջանի հետ, կխթանի տնտեսությունը ազգային և տեղական մակարդակով: Մինևույն



Contract T4-CS-01-D: Design for Gogjanan-Agnak road (Tranche 4)

mining activities.

With reference to the project and the reasons above, we kindly ask you to provide us with the contour of the area under exploitation and of the area granted with mining permit/ concession for the due clearance verification

At the same time we would appreciate your availability to join the public consultation that will be held in Meghri on the 19th of March to present the project and examine together any constraint or opportunity for improvement connected to your activity.

A map with the preliminary alignment is attached for your convenience.

Yours faithfully,

Paolo Orsini
Team Leader and IRD Managing Director

Attachments:

- Map of the impacted area

Ժամանակ, ընկերությունը գիտակցում է, որ ճանապարհի և հանքարդյունահանման աշխատանքների տարածքի հետ կապված կարող են առաջանալ որոշակի խանգարող հանգամանքներ:

Ուստի, հաշվի առնելով վերոնշյալ հանգամանքները՝ խնդրում ենք տրամադրել շահագործվող տեղամասի և օգտակար հանածոների արդյունահանման թույլտվության/ կոնցեսիայով տրամադրված տարածքի ուրվագիծը՝ թունելի համար անվտանգ հեռավորությունը ճշտագտելու նպատակով:

Միևնույն ժամանակ, շնորհակալ կլինենք, եթե հնարավոր լինի Ձեր մասնակցությունը ծրագրի վերաբերյալ Մեղրիում մարտի 19-ին կայանալիք հանրային քննարկումներին՝ նախագիծը ներկայացնելու և Ձեր գործունեության հետ կապված ցանկացած սահմանափակում կամ բարելավման հնարավորություն միասին ուսումնասիրելու նպատակով:

Կից ներկայացնում ենք նախնական ծրագծով քարտեզը:

Հարգանքով՝

Պատու Օրսինի
Թիմի ղեկավար և
Այ.Ար.Դի. ԷնՋինեering Ս.Բ.Է.
Գլխավոր տնօրեն

Կից փաստաթղթեր՝

- Ազդակիր տարածքի քարտեզ



Contract T4-CS-01-D : Design for Qajaran-Igarink road (Tranche 4)





Contract T4-CS-01-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

Date: 05/10/2020
Ref: ARM007/20-030

To: Zangezur Copper-Molybdenum COMBINE CJSC

Attn. Mr. M.Poloskov
General Manager

CC to: Road Department State Non-Commercial Organization (SNCO)

Government Building 3, 1st Floor
Republic Square
0010 - Yerevan
Republic of Armenia

Mr. Stepan Machyan
Acting General Director

Mr. Karen Badalyan
Project Director

Contract: T4-CS-01-D, Qajaran/Agarak (Tranche 4)

Subject: Data collection

Reference: N/A

Dear Mr. Poloskov,

The Armenian Branch of "IRD ENGINEERING" LLC, according to the contract No. T4-CS-01-D signed with the RA Ministry of Transport and Communication, implements the works of identifying and fixing the existing communications of the Meghri-Qajaran section of the North-South Road Corridor within the frameworks of the project "Preparation of detailed design, land acquisition and resettlement plan of about 32 km road from Agarak to tunnel exit; and preparation of detail design, land acquisition and resettlement plan on about 7 km from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)".

The route of the projected road is given in dwg h kmz files on enclosed disc.

In case of existence of any communications in the given section, please provide their data in dwg and kmz format files.

If you have any questions, please contact Mr. Samvel Majaryan by mobile number: +37499000811, e-mail address: samvel.majaryan@gmail.com

Yours faithfully,

Fabio Buonomo
Consultant's Authorized Representative

Joint Venture IRD ENGINEERING - GPINGEGNERIA
Office Address - Elite Plaza Business Center - 0010, 15 Movses Khorenatsi Street, Yerevan, Armenia

1/2



Contract T4-CS-01-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

Մտնաթիվ՝ 05/10/2020
Համար՝ ARM007/20-030

Հասցեագրված է՝	Քանգեզուրի պրեկտորի լիցենզիային կամրիստա ՓԲԸ պրն. Մ.Պոլսկովին Գլխավոր տնօրեն
Պատճեն՝	«Ճանապարհային դեպարտամենտ» ՊՈԱԿ Կառավարական N3 ստանալենց, 1-ին հարկ, Հանրապետության կառավարան 0010 Երևան, Հայաստանի Հանրապետություն պրն. Ստեփան Մալոյանին, Գլխավոր տնօրենի ժամանակավոր պաշտոնակատար պրն. Կարեն Տադադյանին, Ծրագրի ղեկավար
Պարմանագիր՝	T4-CS-01-D, Քաջարան Ագարակ (Տրանշ 4)
Թեմա՝	Տվյալների հավաքում
Հղում՝	N/A

Հարգելի պարոն Պոլսկով

«ԱՅԵՈՂԻ Էնջինիթիկ» ՍՊԸ Հայաստանյան մասնաճյուղը, համաձայն ՀՀ Տրանսպորտի և կապի նախարարության հետ կնքված թիվ T4-CS-01-D պայմանագրի, «Ագարակից մինչև թունելի ելք մոտ 32 կմ ճանապարհահատվածի մանրամասն նախագծային փաթեթի, հողերի օտարման և տարաբնակեցման ծրագրի մշակում, թունելի մուտքից դեպի Քաջարան մոտ 7կմ ճանապարհահատվածի, 6կմ թունելի և իջատեղերի ճանապարհների մանրամասն նախագծային փաթեթի, հողերի օտարման և տարաբնակեցման ծրագրի մշակում (Տրանշ 4)» ծրագրի շրջանակներում իրականացնում է Հյուսիս-Հարավ ճանապարհային միջանցքի Մերի-Քաջարան նախագծվող հատվածի գոյություն ունեցող կոմունիկացիաների հայտնաբերման և ֆիքսման գործընթացը:

Կից սկսվաւաւակով երկնայացվում է նախագծվող ճանապարհի ուղեգիծը, ժաց և կառ ֆայլերով:

Եզված հատվածում գոյություն ունեցող կոմունիկացիաների առկայության դեպքում խնդրում եմ տրամադրել դրանց սվյալները ժաց և կառ ֆայլերով:

Հարցերի դեպքում դիմել Սամվել Մաջարյանին +37499000811 հեռախոսահամարով, samvel.majaryan@gmail.com էլեկտրոնային հասցեով:



Contract T4-CS-02-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajarian and about 6 km of the tunnel and access roads (Tranche 4)

Հարգանքով,

Տսրին Աւակնյան,
Խորհրդապատուի վարչար ներկայացուցիչ:



Contract T4-CS-01-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

Date: 24/06/2021
Ref: ARM007/21-096
To: «Zangezur Copper and Molybdenum Combine» CJSC

Attn: Mr. Parag Johannes Bhat
General Director

Contract: T4-CS-01-D, Qajaran/Agarak (Tranche 4)

Subject: Request for a meeting with engineering technician team

Ամսաթիվ՝ 24/06/2021
Համար՝ ARM007/21-096
Հասցեագրված է՝ « Զանգեզուրի պղնձամոլիբդենային կոմբինատ» ՓԲԸ

Գլխավոր տնօրեն՝ պրն. Պարագ Յոհանես Բհատին

Պայմանագիր՝ T4-CS-01-D, Քաջարան/Ագարակ (Տրանշ 4)

Թեմա՝ Ինժեներատեխնիկական անձնակազմի հետ հանդիպման առաջարկ

Dear Mr. Bhat,

Within the framework of the Project, T4-CS-01-D, Qajaran/Agarak (Tranche 4), IRD Engineering S.R.L. has already started utilities relocation designs, and there is need for a meeting with your engineering technician team to agree on the design solutions as work proceeds.

For the date of the meeting, please contact Samvel Majaryan (tel. +374 99 000933. samvel.majaryan@gmail.com).

Հարգելի պարոն Բհատ,

T4-CS-01-D, Քաջարան/Ագարակ (Տրանշ 4) ծրագրի շրջանակներում «ԱՅԵՌԴԻ Էնջինիրինգ» ՍՊԸ արդեն սկսել է հաղորդուղիների (կոմունիկացիաներ) տեղափոխման նախագծերը, և անհրաժեշտություն է առաջացել հանդիպելու Ձեր ինժեներատեխնիկական անձնակազմի հետ՝ նախագծային լուծումներն աշխատանքային կարգով համաձայնեցնելու նպատակով:

Հանդիպման օրվա հետ կապված խնդրում եմ կապ հաստատել Սամվել Մաջարյանի հետ +374 99 000933 հեռախոսահամարով կամ samvel.majaryan@gmail.com էլ. փոստով:

Yours faithfully,

Fabio Buonomo
Consultant's Authorized Representative

Հարգանքով,

Ֆաբիո Բուոնոմո
Խորհրդատուի լիազոր ներկայացուցիչ



ANNEX 13: PICTURES OF FIELD WORKS

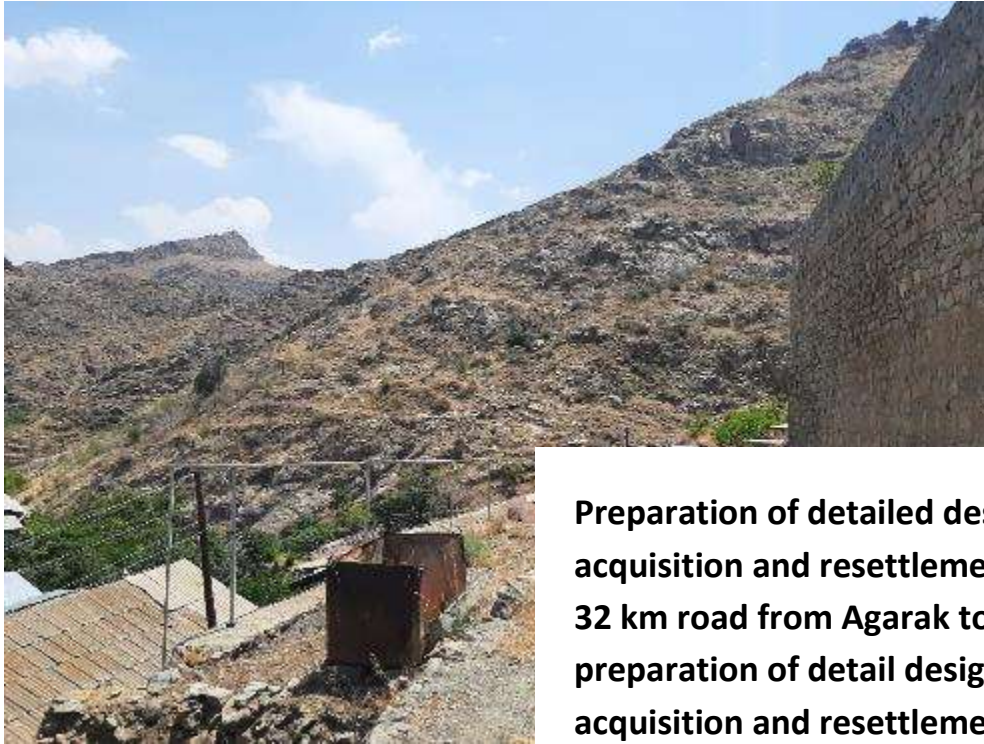








ANNEX 14: MEASUREMENTS PROTOCOLS



Preparation of detailed design, land acquisition and resettlement plan of about 32 km road from Agarak to tunnel exit; and preparation of detail design, land acquisition and resettlement plan on about 7 km from tunnel entrance to Kajaran and about 6 km of the tunnel and access roads (Tranche 4)

DUST, NOISE, VIBRATION AND WATER QUALITY BASELINE ASSESSMENT REPORT

Rev01

August 2021

**Prepared for:
IRD Engineering Ltd.**

**Prepared by:
ATMS Solutions Ltd.**



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1. Introduction

According to the Contract signed on 29.07.2021 the Armenian Branch of IRD Engineering (hereinafter - the "Client") assigned ATMS Solutions Ltd. (hereinafter - the "Performer") to conduct instrumental measurements of dust concentration, noise and vibration levels as well as surface water samplings and chemical analysis within the area of direct influence of the Project "Preparation of detailed design, land acquisition and resettlement plan of about 32 km road from Agarak to tunnel exit; and preparation of detail design, land acquisition and resettlement plan on about 7 km from tunnel entrance to Quajaran and about 6 km of the tunnel and access roads (Tranche 4)", assess the obtained data and present them to the Client as a report (hereinafter - "Baseline study" or the "Assignment"):

This Baseline study report provides an overview of the measurement process and equipment, description of the measurement (sensitive) points, dust, noise, vibration and water quality national norms and standards, a quantitative analysis, assessment of measurement results and main conclusions. The instrumental measurements water conducted and water samplings were taken on 29-30 of July 2021 at sensitive points identified by the Client. The maps of dust, noise and vibration measurements and water sampling points/locations are presented in [Annexes 1](#) and [2](#) while their descriptions are given below in [Table 1](#).

Table 1. Description of dust, noise, vibration instrumental measurements and water sampling points identified by the Client

Points/ locations	GPS coordinates	Parameters to be measured	Section	Status
Point 1-DNV	X=38°51'36.31"C Y=46°12'51.33"B	Dust (PM2.5 and PM10 ⁸)	Administrative territory of Agarak settlement	Baseline assessment
		Noise		
		Vibration		
Point 2-DNV	X=38°53'11.85"C Y=46°15'29.21"B	Dust (PM2.5 and PM10)	Administrative territory of Meghri community (out of the city)	
		Noise		
		Vibration		
Point 3-DNV	X=38°53'44.96"C Y=46°15'0.65"B	Dust (PM2.5 and PM10)	Administrative territory of Meghri community	
		Noise		
		Vibration		
Point 4-DNV	X=38°54'9.48"C Y=46°14'26.28"B	Dust (PM2.5 and PM10)	Meghri community (within the city)	
		Noise		
		Vibration		
Point 5-DNV	X=38°55'12.57"C Y=46°13'21.10"B	Dust (PM2.5 and PM10)	Administrative territory of Meghri community	
		Noise		
		Vibration		
Point 6-DNV	X=38°56'20.20"C Y=46°13'9.21"B	Dust (PM2.5 and PM10)	Administrative territory of Lehvaz community	
		Noise		
		Vibration		
Point 7-DNV	X=38°58'16.48"C Y=46°12'49.16"B	Dust (PM2.5 and PM10)	Administrative territory of	
		Noise		

⁸Particulate matters



Points/ locations	GPS coordinates	Parameters to be measured	Section	Status
		Vibration	Vardanidzor community	
Point 8-DNV	X=38°59'19.64"C Y=46°12'22.53"B	Dust (PM2.5 and PM10)	Administrative territory of Tkhkut community	
		Noise		
		Vibration		
Point 9-DNV	X=39° 1'15.30"C Y=46°12'23.76"B	Dust (PM2.5 and PM10)	Administrative territory of Lichk community	
		Noise		
		Vibration		
Point 10-DNV	X=39° 2'22.93"C Y=46°12'2.87"B	Dust (PM2.5 and PM10)	Administrative territory of Lichk community	
		Noise		
		Vibration		
Point 11-DNV	X=39° 9'4.21"C Y=46°11'22.74"B	Dust (PM2.5 and PM10)	Administrative territory of Qajaran community (near Lernadzor village)	
		Noise		
		Vibration		
Point 12-DNV	X=39° 9'25.89"C Y=46°12'4.60"B	Dust (PM2.5 and PM10)	Administrative territory of Qajaran community	
		Noise		
		Vibration		
Point Water-1	X=38°53'13.42"N Y=46°15'55.52"E	BOD, COD, pH, colour, odour, TSS, phosphates, carbonates, sulphates, nitrates, chlorides, fluorides, bromides, mineralization, transparency	Administrative territory of Meghri community (out of the city)	Baseline assessment
Point Water-2	X=38°54'29.38"N Y=46°14'2.97"E		Meghri community (within the city)	
Point Water-3	X=38°54'42.90"N Y=46°13'55.30"E		Meghri community (within the city)	
Point Water-4	X=38°55'27.29"N Y=46°13'12.14"E		Administrative territory of Lehvaz community	
Point Water-5	X=38°56'21.09"N Y=46°13'3.47"E		Administrative territory of Lehvaz community	
Point Water-6	X=38°58'16.84"N Y=46°12'48.66"E		Administrative territory of Vardanidzor community	
Point Water-7	X=38°58'37.54"N Y=46°12'46.56"E		Administrative territory of Tkhkut community	
Point Water-8	X=39° 2'24.42"N Y=46°12'8.92"E		Administrative territory of Lichk community	



Points/ locations	GPS coordinates	Parameters to be measured	Section	Status
Point Water-9	X=39° 9'1.20"N Y=46°10'55.70"E		Administrative territory of Qajaran community	

The objective of this Assignment is:

- 1) Determine baseline noise and vibration levels as well as dust concentration in the ground layer of atmospheric air through the instrumental measurements within the area of Project direct influence,
- 2) Determine the content of the parameters characterizing the quality of surface water resources located within the area of Project direct influence through the water sampling and chemical analysis performed in the specialized laboratory,
- 3) Compare the results of noise, vibration and dust instrumental measurements and surface water chemical analysis with the Republic of Armenia ("RA") sanitary-hygienic and environmental norms and present the obtained results in a form of professional conclusions.

2. Abbreviation

Ltd.	- Limited Liability Company
SNCO	- State Non-Commercial Organization
BOD	- Biological Oxygen Demand
COD	- Chemical Oxygen Demand
RA	- Republic of Armenia
EDB	- Eurasian Development Bank
PIU	- Project Implementation Unit
TLV	- Threshold Limit Value
MPC	- Maximum Permissible Concentration
BC	- Background Concentration.

3. Project Description

The RA and the Eurasian Development Bank ("EDB") have signed a loan agreement for the implementation of Tranche 4 of the North-South Road Corridor Investment Program Kajaran-Agarak Road section (southern part / Iran border). The RA Ministry of Territorial Administration and Infrastructure ("MTAI") is responsible for the general coordination of the Program. The Road Department State Non-Commercial Organization ("SNCO") has been appointed as a Project Implementing Agency ("PIU") in accordance with the agreement between the RA MTAI and the Road Department.



The "North-South Road Corridor Investment Program" is a major infrastructure project in Armenia. It aims at linking the Southern border of the country with its Northern point, being also part of the Asian Highway corridor (AH 82), which connects the Central Asian countries. The reconstruction of the current road of 556 km with an average speed of 60 km/h into a 470 km-road with a 100 km/h design speed will decrease travelling time from over 9 hours to just 4.5 hours and will ensure an easier transit from the Southern border of Armenia to the Georgian border and up to Black Sea ports.

The estimated cost of the Program is 1.5 billion USD. The Project is divided into 6 tranches. The implementation of each tranche envisions the conclusion of separate loan agreements:

- Tranche 1 (Yerevan - Ashtarak 11.4 km, Yerevan - Artashat 19.6 km) total length is around 31 km. The scope of works included dismantling of the existing asphalt pavement, rehabilitation of sub-base, concrete pavement laying, reconstruction of existing engineering structures, construction of drainage system, upgrading of road safety including installation of traffic signs.
- Tranche 2 (Ashtarak - Talin section) envisions reconstruction of 41.9 km road section and widening of the existing 2-lanes up to 4-lanes. The new alignment is envisaged for 15.32 km section and works for widening of the existing 2-lane road up to 4-lane road will be implemented for 26.58 km section and construction of parallel carriageway. After reconstruction, this road section will be of 1st technical category.
- Tranche 3 (Talin-Lanjik 18.7 km (km 71+500 - km 90+200), Lanjik-Gyumri 27.5 km (km 90+200 - km 117+670)) total length is around 46.2 km. The scope of works consists of widening of the existing 2-lane road up to 4-lane road in all sections except a 3.5 km section which will be a completely new road, construction of 9 transport junctions, construction of structures, including: 13 agricultural machinery crossings, 3 cattle crossings, 93 storm sewers, bridges and culverts. After reconstruction, this road section will be of 1st technical category.
- Tranche 4 consists of Artashat-Sisian, Sisian-Kajaran and Kajaran-Agarak road sections. It starts in Artashat city and ends at the RA border with the Islamic Republic of Iran.
- Tranche 5 - (Gyumri bypass and Gyumri-Bavra section) total length is around 62 km. It starts in Gyumri city and ends at the RA border with Georgia. The Tranche 5 consists of two sections: the 1st is Gyumri bypass road, the 2nd - road to the Georgian border.
- Tranche 6 is the Yerevan south-east bypass road that should connect two sections of Tranche 1, i.e. the southern and northern roads of North-South Road Corridor.

4. Measurement Framework, Methodology and Equipment

4.1 Dust (PM_{2.5} and PM₁₀)

Dust concentration is measured by air quality testing device BR-Smart ([Fig. 1](#)). This device is equipped with 2.5µm and 10µm size channels to measure PM_{2.5} and PM₁₀ simultaneously as well

as concentrations of formaldehyd and volatile organic compounds. The duration of each measurement is 10 minutes which is enough to get the average values. Three measurements were conducted at each measurement point during the day.

The technical characteristics of BR-Smart are the following:

- 2.5 μm (PM2.5) and 10 μm (PM10) size channels:
 - Measurement range of PM2.5 - 0-999 μm /m³, resolution - 1 μm /m³,
 - Measurement range of PM10 - 0-999 μm /m³, resolution - 1 μm /m³,
 - Temperature range - 0-50°C,
 - Humidity range - 0-90%:
- Device verification data:

Factory №	Verification		
	certificate №	Date	Valid until
S642603	033950	06.08.2020	06.08.2021

The measurements are conducted in accordance with the below listed national normative documents and international best practices:

- GOST 17.2.4.05-83. "Environmental protection. Atmosphere. Gravimetric method for determination of suspended dust particles",
- Government Decree № 160-N. "Norms of maximum permissible concentrations (MPC) of atmospheric air pollutants in residential areas",
- BR-Smart Air quality testing device manual.

Fig. 1. Air quality testing device BR-Smart



The daily average and maximum permissible concentrations of PM2.5 and PM10 are presented in **Table 1**.

Table 2. Daily average and maximum permissible concentrations of PM2.5 and PM10

№	Name of substance	MPC (mg/m ³)	
		Max	Daily average



1	PM2.5	0.16	0.035
2	PM10	0.3	0.06

4.2 Noise

Instrumental measurements of noise levels are performed using a sound level meter (SLM) "WS1361". The SLM consists of a microphone, electronic circuits and a readout display. The microphone detects the small air pressure variations associated with sound and transforms them into electrical signals. Afterwards, these signals are processed by the electronic circuitry of the instrument. The readout displays the sound level in decibels.

The SLM has SLOW and FAST response options. The response rate is the time period over which the instrument averages the sound level before displaying it on the readout. Usually measurements of background noise are taken in the SLOW response mode. Three measurements were conducted at each measurement point during the day.

The technical characteristics of BR-Smart are the following:

- Measurement range: 30÷130 dB (sub-ranges: 30÷80, 40÷90, 50÷100, 60÷110, 70÷120, 80÷130, 90÷130),
- Frequency range: 31.5÷8500 Hz,
- Accuracy: ±1.5 dB,
- Device verification data:

Factory №	Verification		
	certificate №	Date	Valid until
-	034161	06.08.2020	06.08.2021

In order to ensure continuous measurements over a certain period of time and further analysis of the results, the SLM WS1361 is connected to a tablet (**Fig. 2**). The special software installed in the tablet allows recording noise levels with one second frequency and provides complete information on the noise level (both in digital imaging and as a graph), including the minimum, maximum and average values of the sound level.

Instrumental measurement, analysis and evaluation of results are carried out in accordance with the following regulations/standards:

- Sanitary Norms № 2-III-11.3 "Noise in the workplaces, in residential and public buildings and in residential construction areas" adopted by the order of RA Minister of Health №138 on 06.03.2002,
- Manual of SLM "WS1361".

Measurements of noise levels were conducted during the daytime. The obtained results have been compared with the Threshold Limit Values ("TLV") given in **Table 3**.

Table 3. Threshold limit values (TLV) for noise⁹

⁹Only noise TLVs for day-time are presented in Table 3

No	Premises and territories	TLV (equivalent to sound level), dBA	TLV (maximum sound level), dBA
1	Workplace	80	
2	Shops trading halls, airport and railway stations waiting rooms, drop-off points of public service providers	60	75
3	Territories adjacent to residential buildings, clinics, ambulatories, rest houses, care homes, disabled persons homes, libraries, kinder gardens, schools and other educational facilities	55	70

Fig. 2. Sound level meter (SLM) "WS1361"



4.3 Vibration

Instrumental measurements of vibration levels are performed using a combined noise and vibration analyzer "Assistant SI V3RT" (Fig. 3) that has the following technical characteristics:

- Nominal range of scale: 70÷170 dB,
- Frequency range: 6.3÷1250 Hz (for hand-arm vibration), 0.8÷80 Hz (for whole-body vibration),
- Accuracy: ±0.5 dB,
- Working conditions:
 - Temperature: from -10°C to +50°C,
 - Relative humidity: up to 90°C,
 - Pressure: 90÷110 kPa.
- Device verification data:

Factory No	Verification		
	certificate No	Date	Valid until
283518	034163	06.08.2020	06.08.2021

Instrumental measurement, analysis and evaluation of results are carried out in accordance with the following regulations/standards:

- GOST 31319-2006 (EN 14253) "Mechanical vibration. Measurement and assessment of occupational exposure to whole-body vibration with reference to health. Requirements for measurement at the workplace",
- Hygienic Norms №2-III-11.3 "Vibration in the workplaces, in residential and public buildings",
- Manual of combined noise and vibration analyzer "Assistant SI V3RT".

Fig. 3. Combined noise and vibration analyzer "Assistant SI V3RT"



The duration of each measurement is 10 minutes which is enough to get the average values. Three measurements were conducted at each measurement point during the day. The obtained results have been compared with the TLVs set by the Hygienic Norms №2.2.4-009-06 "Vibration in the workplaces, in residential and public buildings" and summarized in **Table 4**. For the given assignment the transport-technological vibration acceleration levels were used as a normative value.

Table 4. Threshold limit values (TLV) for vibration acceleration

№	Whole-body vibration	TLV for corrected and equivalent corrected values	
		m/sec ²	dB
1	Transport-technological (2nd category)	0.28	109
2	Technological (3rd category a)	0.1	100
3	Technological (3rd category b)	0.04	92
4	Technological (3rd category g)	0.014	83
5	Residential buildings, clinics	0.004	72



Verification certificates of dust, noise and vibration are presented in [Annex 3](#).

4.4 Water Quality

The water samplings from the Debed River were performed by the Performer's measurement engineer on 30-31 of July 2021. The chemical analysis of the sampled water was conducted by the laboratory of the "Environmental Impact Monitoring Center" SNCO. Water samplings were performed from 9 points/locations (see [Figures 4-12](#)). The obtained results were assessed and compared with water quality norms set by the RA Government Decree №75-N "On definition of the water quality assurance norms for the every water basin management areas depending on the specifics of locations" dated 27.01.2011.

Currently, the quality of surface water in the RoA is monitored in accordance with the principles of the EU water framework directive. This system is defined by the RA Government Decree No 75-N (dated 27.01.2011) and applied since January 2013. The classification scheme that envisaged 5 classes for each parameter of surface water quality has been elaborated. These 5 classes are: excellent (class I), good (class II), average (class III), poor (class IV) and bad (class V) and vary depending on the intended purpose of surface water (see [Table 5](#)). The rivers of Meghri River basin are located within the area of Project influence; therefore, the results of the water chemical analysis shall be compared with the water quality environmental norms set by the Annex 25 of RA Government Decree №75-N and summarized in [Table 6](#).

Table 5. Surface water quality classes depend on the water usage purposes as per the RA Government Decree №75-N

Purpose/ designation	Notes	Class I, excellent	Class II, good	Class III average	Class IV, poor	Class V, bad
National water reserve		X	X	X	X	X
Preservation of water flows/ streams		X	X	-	-	-
Eco-systems, fish breeding/preservation	Salmons	X	X	-	-	-
	Carps	X	X	X	-	-
Irrigation*		X	X	X	X	-
Industrial water usage		X	X	X	X	X
Energy generation		X	X	X	X	X
X	<i>applicable</i>					
-	<i>N/A</i>					
*	<i>The water for the irrigation purposes can be used when the pH is not above the 8.5 and the value of Specific electrical conduction is below the 1000 uS/cm²</i>					

Table 6. The water quality environmental norms of the rivers of the Meghri River basin

Quality indicators	Class					Units
	I	II	III	IV	V	
Dissolved oxygen	>7	>6	>5	>4	<4	mgO ₂ /l
BOD ₅	3	5	9	18	>18	mgO ₂ /l
COD-Cr	10	25	40	80	>80	mgO ₂ /l
Ammonia	0.033	0.4	1.2	2.4	>2.4	mgN/l



Quality indicators	Class					Units
	I	II	III	IV	V	
Nitrites	0.009	0.060	0.120	0.300	>0.300	mgN/l
Nitrates	0.631	2.500	5.600	11.300	>11.300	mgN/l
Phosphates	0.032	0.100	0.200	0.400	>0.400	mg/l
Zn	2.0	100.0	200.0	500.0	>500.0	µg/l
Cu	4.0	24.0	50.0	100.0	>100.0	µg/l
Cr	1.0	11.0	100.0	250.0	>250.0	µg/l
As	0.880	20.88	50	100	>100	µg/l
Cd	0.036	1.036	2.036	4.036	>4.036	µg/l
Pb	0.18	10.18	25	50	>50	µg/l
Ni	0.64	10.64	50	100	>100	µg/l
Mo	6	12	24	48	>48	µg/l
Mn	4	8	16	32	>32	µg/l
V	1	2	4	8	>8	µg/l
Co	0.121	0.242	0.484	0.968	>0.968	µg/l
Fe	0.071	0.142	0.5	1	>1	mg/l
Ca	17.0	100	200	300	>300	mg/l
Mg	3.5	50	100	200	>200	mg/l
Ba	30	60	120	1000	>1000	µg/l
Be	0.008	0.016	0.032	100	>100	µg/l
K	1.5	3.0	6.0	12.0	>12.0	mg/l
Na	6.12	12.24	24.48	48.96	>48.96	mg/l
Li	7	7		<2500	>2500	µg/l
B	80	450	700	1000	>2000	µg/l
Al	31	62	124	5000	>5000	µg/l
Se	0.26	20	40	80	>80	µg/l
Sb	0.44	0.88	1.76	3.52	>3.52	µg/l
Sn	0.07	0.14	0.28	0.56	>0.56	µg/l
COD-Mn	5	10	15	20	>20	mgO ₂ /l
N, total	0.85	4	8	16	>16	mgN/l
P, total	0.03	0.2	0.4	1	>1	mg/l
Chlorides	9.23	18.46	150	200	> 200	mg/l
Sulphates	16.82	33.64	150	250	> 250	mg/l
Silicates	5.32	10.64	21.28	42.56	>42.56	mgSi/l
Mineralization	163	326	1000	1500* 1000 for irrigation	>1500	mg/l



Quality indicators	Class					Units
	I	II	III	IV	V	
Specific electrical conduction	237	474	1000	1500* 1000 for irrigation	>1500	μS/cm ²
Hardness	1.2	10	20	40	<40	mgeq/l
TSS	7.4	8.9	14.8	29.6	>29.6	mg/l
Odour (20°C and 60°C)	<2 (natural)	2 (natural)	2	4	>4	grade
Colour	(natural)	<5 (natural)	20	30	>200	degree

Water sampling points

Fig. 4. Sampling point "Point Water-1"



Fig. 5. Sampling point "Point Water-2"



Fig. 6. Sampling point "Point Water-3"



Fig. 7. Sampling point "Point Water-4"



Fig. 8. Sampling point "Point Water-5"

Fig. 9. Sampling point "Point Water-6"



Fig. 10. Sampling point "Point Water-7"



Fig. 11. Sampling point "Point Water-8"



Fig. 12. Sampling point "Point Water-9"





5. Measurement Results and Evaluation

5.1 Dust, Noise and Vibration

The instrumental measurement results at each sensitive point are presented in relevant measurements and summarized in [Table 7](#) (for dust), [Table 8](#) (for noise) and [Table 9](#) (for vibration) accordingly. Diagrams, demonstrating comparisons of actual dust (PM2.5 and PM10) concentration values with MPC (both average daily and maximum) are presented in [Figures 13-14](#). The noise and vibration levels compared with the defined TLVs are shown in [Figures 15](#) and [16](#) respectively. As mentioned before, the 3 measurements were conducted at each point/location and the average values were used for the evaluations.

Table 7. The results and average values of dust (PM2.5 and PM10) instrumental measurements at sensitive points within the Project area of influence

Measurements		Dust actual concentration, mg/m ³	Maximum permissible concentration (MPC) for dust, mg/m ³	
			Daily average	Maximum value
Point 1-DNV				
1st measurement	PM2.5	0.006	0.035	0.16
	PM10	0.006	0.06	0.3
2nd measurement	PM2.5	0.007	0.035	0.16
	PM10	0.009	0.06	0.3
3rd measurement	PM2.5	0.009	0.035	0.16
	PM10	0.011	0.06	0.3
Average value	PM2.5	0.0073	0.035	0.16
	PM10	0.0087	0.06	0.3
Point 2-DNV				
1st measurement	PM2.5	0.007	0.035	0.16
	PM10	0.007	0.06	0.3
2nd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.01	0.06	0.3
3rd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.01	0.06	0.3
Average value	PM2.5	0.0077	0.035	0.16
	PM10	0.009	0.06	0.3
Point 3-DNV				
1st measurement	PM2.5	0.009	0.035	0.16
	PM10	0.012	0.06	0.3
2nd measurement	PM2.5	0.004	0.035	0.16
	PM10	0.005	0.06	0.3
3rd measurement	PM2.5	0.006	0.035	0.16
	PM10	0.006	0.06	0.3



Measurements		Dust actual concentration, mg/m ³	Maximum permissible concentration (MPC) for dust, mg/m ³	
			Daily average	Maximum value
Average value	PM2.5	0.0063	0.035	0.16
	PM10	0.0077	0.06	0.3

Point 4-DNV

1st measurement	PM2.5	0.008	0.035	0.16
	PM10	0.008	0.06	0.3
2nd measurement	PM2.5	0.006	0.035	0.16
	PM10	0.006	0.06	0.3
3rd measurement	PM2.5	0.005	0.035	0.16
	PM10	0.006	0.06	0.3
Average value	PM2.5	0.0063	0.035	0.16
	PM10	0.0067	0.06	0.3

Point 5-DNV

1st measurement	PM2.5	0.009	0.035	0.16
	PM10	0.009	0.06	0.3
2nd measurement	PM2.5	0.007	0.035	0.16
	PM10	0.008	0.06	0.3
3rd measurement	PM2.5	0.006	0.035	0.16
	PM10	0.009	0.06	0.3
Average value	PM2.5	0.0073	0.035	0.16
	PM10	0.0087	0.06	0.3

Point 6-DNV

1st measurement	PM2.5	0.012	0.035	0.16
	PM10	0.013	0.06	0.3
2nd measurement	PM2.5	0.011	0.035	0.16
	PM10	0.011	0.06	0.3
3rd measurement	PM2.5	0.007	0.035	0.16
	PM10	0.009	0.06	0.3
Average value	PM2.5	0.01	0.035	0.16
	PM10	0.011	0.06	0.3

Point 7-DNV

1st measurement	PM2.5	0.009	0.035	0.16
	PM10	0.011	0.06	0.3
2nd measurement	PM2.5	0.007	0.035	0.16
	PM10	0.007	0.06	0.3
3rd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.008	0.06	0.3
Average value	PM2.5	0.008	0.035	0.16
	PM10	0.0087	0.06	0.3



Measurements	Dust actual concentration, mg/m ³	Maximum permissible concentration (MPC) for dust, mg/m ³	
		Daily average	Maximum value

Point 8-DNV

1st measurement	PM2.5	0.008	0.035	0.16
	PM10	0.011	0.06	0.3
2nd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.009	0.06	0.3
3rd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.008	0.06	0.3
Average value	PM2.5	0.008	0.035	0.16
	PM10	0.0093	0.06	0.3

Point 9-DNV

1st measurement	PM2.5	0.007	0.035	0.16
	PM10	0.008	0.06	0.3
2nd measurement	PM2.5	0.005	0.035	0.16
	PM10	0.005	0.06	0.3
3rd measurement	PM2.5	0.008	0.035	0.16
	PM10	0.008	0.06	0.3
Average value	PM2.5	0.0067	0.035	0.16
	PM10	0.007	0.06	0.3

Point 10-DNV

1st measurement	PM2.5	0.007	0.035	0.16
	PM10	0.007	0.06	0.3
2nd measurement	PM2.5	0.009	0.035	0.16
	PM10	0.012	0.06	0.3
3rd measurement	PM2.5	0.006	0.035	0.16
	PM10	0.006	0.06	0.3
Average value	PM2.5	0.0073	0.035	0.16
	PM10	0.0083	0.06	0.3

Point 11-DNV

1st measurement	PM2.5	0.006	0.035	0.16
	PM10	0.007	0.06	0.3
2nd measurement	PM2.5	0.004	0.035	0.16
	PM10	0.004	0.06	0.3
3rd measurement	PM2.5	0.006	0.035	0.16
	PM10	0.007	0.06	0.3
Average value	PM2.5	0.0053	0.035	0.16
	PM10	0.006	0.06	0.3

Point 12-DNV

	PM2.5	0.007	0.035	0.16
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Measurements		Dust actual concentration, mg/m ³	Maximum permissible concentration (MPC) for dust, mg/m ³	
			Daily average	Maximum value
1st measurement	PM10	0.007	0.06	0.3
2nd measurement	PM2.5	0.004	0.035	0.16
	PM10	0.005	0.06	0.3
3rd measurement	PM2.5	0.01	0.035	0.16
	PM10	0.01	0.06	0.3
Average value	PM2.5	0.007	0.035	0.16
	PM10	0.0073	0.06	0.3

Table 8. The results of noise instrumental measurements at sensitive points within the Project area of influence

Measurements	Sound level (equivalent to sound level), LAeq, dBA	Maximum sound level, LAmax, dBA	Threshold limit value (equivalent to sound level), dBA	Threshold limit value (maximum sound level), dBA
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Point 1-DNV

1st measurement	51.6	82.5	55	70
2nd measurement	53.4	80.1		
3rd measurement	51.7	77.8		
Average value	52.2	80.1		

Point 2-DNV

1st measurement	56.0	78.5	55	70
2nd measurement	62.0	84.4		
3rd measurement	64.0	89.4		
Average value	60.6	84.1		

Point 3-DNV

1st measurement	49.6	69.4	60	75
2nd measurement	53.9	73.3		
3rd measurement	55.5	69.7		
Average value	53.0	70.8		

Point 4-DNV

1st measurement	49.3	65.9	60	75
2nd measurement	59.9	69.1		
3rd measurement	57.4	65.9		
Average value	55.5	66.9		

Point 5-DNV



Measurements	Sound level (equivalent to sound level), LAeq, dBA	Maximum sound level, LAmax, dBA	Threshold limit value (equivalent to sound level), dBA	Threshold limit value (maximum sound level), dBA
1st measurement	50.3	72.7	60	75
2nd measurement	62.5	77.8		
3rd measurement	62.2	75.0		
Average value	58.3	75.1		

Point 6-DNV

1st measurement	51.9	69.8	60	75
2nd measurement	56.2	78.7		
3rd measurement	58.3	81.0		
Average value	55.4	76.5		

Point 7-DNV

1st measurement	47.3	69.3	60	75
2nd measurement	47.2	69.1		
3rd measurement	46.5	69.5		
Average value	47.0	69.3		

Point 8-DNV

1st measurement	43.7	69.5	60	75
2nd measurement	43.6	68.2		
3rd measurement	46.9	68.8		
Average value	44.7	68.8		

Point 9-DNV

1st measurement	54.0	75.0	60	75
2nd measurement	55.1	79.0		
3rd measurement	50.4	69.9		
Average value	53.1	74.6		

Point 10-DNV

1st measurement	55.5	73.3	60	75
2nd measurement	54.8	69.8		
3rd measurement	52.5	69.2		
Average value	54.2	70.7		

Point 11-DNV

1st measurement	49.5	69.9	60	75
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Measurements	Sound level (equivalent to sound level), LAeq, dBA	Maximum sound level, LAmax, dBA	Threshold limit value (equivalent to sound level), dBA	Threshold limit value (maximum sound level), dBA
2nd measurement	49.7	63.6		
3rd measurement	50.6	68.8		
Average value	49.9	67.4		

Point 12-DNV

1st measurement	44.0	61.6	60	75
2nd measurement	47.9	67.8		
3rd measurement	49.2	69.3		
Average value	47.0	66.2		

Table 9. The results of vibration instrumental measurements at sensitive points within the Project area of influence

Measurements	Vibration category	Corrected and equivalent corrected values, dB		TLV for corrected and equivalent corrected values, dB
		X	Y	
*Point 1-DNV	Transport-technological (2nd category)	X	64.1	
		Y	70.2	
		Z	69.8	
		Average	68.0	109
*Point 2-DNV	Transport-technological (2nd category)	X	71.4	
		Y	73.3	
		Z	79.6	
		Average	74.7	109
*Point 3-DNV	Transport-technological (2nd category)	X	61.0	
		Y	63.0	
		Z	59.6	
		Average	61.2	109
*Point 4-DNV	Transport-technological (2nd category)	X	61.9	
		Y	64.2	
		Z	78.3	
		Average	68.1	109
*Point 5-DNV	Transport-technological (2nd category)	X	70.4	
		Y	70.0	
		Z	71.8	
		Average	70.3	109
*Point 6-DNV	Transport-technological (2nd category)	X	73.5	
		Y	69.4	
		Z	70.7	



Measurements	Vibration category	Corrected and equivalent corrected values, dB		TLV for corrected and equivalent corrected values, dB
		Average		
		Average	71.2	109
*Point 7-DNV	Transport-technological (2nd category)	X	63.4	
		Y	63.1	
		Z	67.1	
		Average	64.5	109
*Point 8-DNV	Transport-technological (2nd category)	X	64.7	
		Y	68.5	
		Z	69.6	
		Average	67.6	109
*Point 9-DNV	Transport-technological (2nd category)	X	77.4	
		Y	74.1	
		Z	74.0	
		Average	74.8	109
*Point 10-DNV	Transport-technological (2nd category)	X	72.6	
		Y	72.9	
		Z	74.9	
		Average	73.4	109
*Point 11-DNV	Transport-technological (2nd category)	X	60.5	
		Y	60.4	
		Z	62.0	
		Average	60.9	109
*Point 12-DNV	Transport-technological (2nd category)	X	65.2	
		Y	74.2	
		Z	61.7	
		Average	67.0	109

Fig. 13. Diagram of PM2.5 concentration actual values in comparison with daily average and maximum MPCs, mg/m³

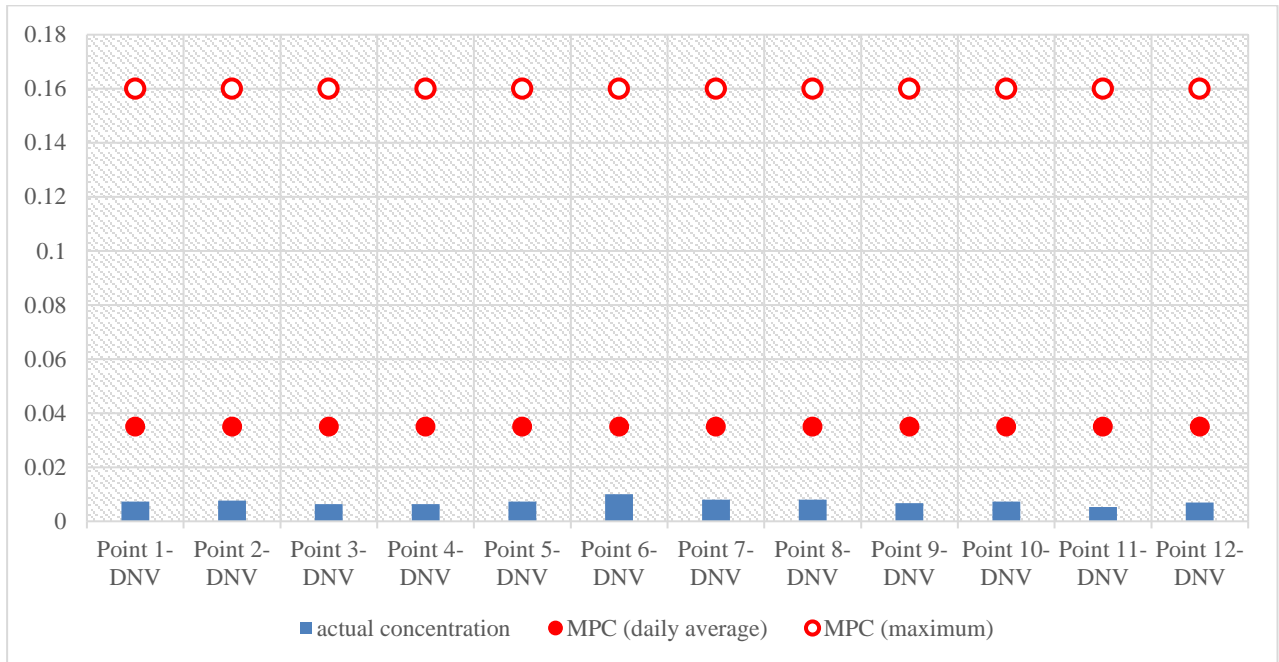


Fig. 14. Diagram of PM10 concentration actual values in comparison with daily average and maximum MPCs, mg/m³

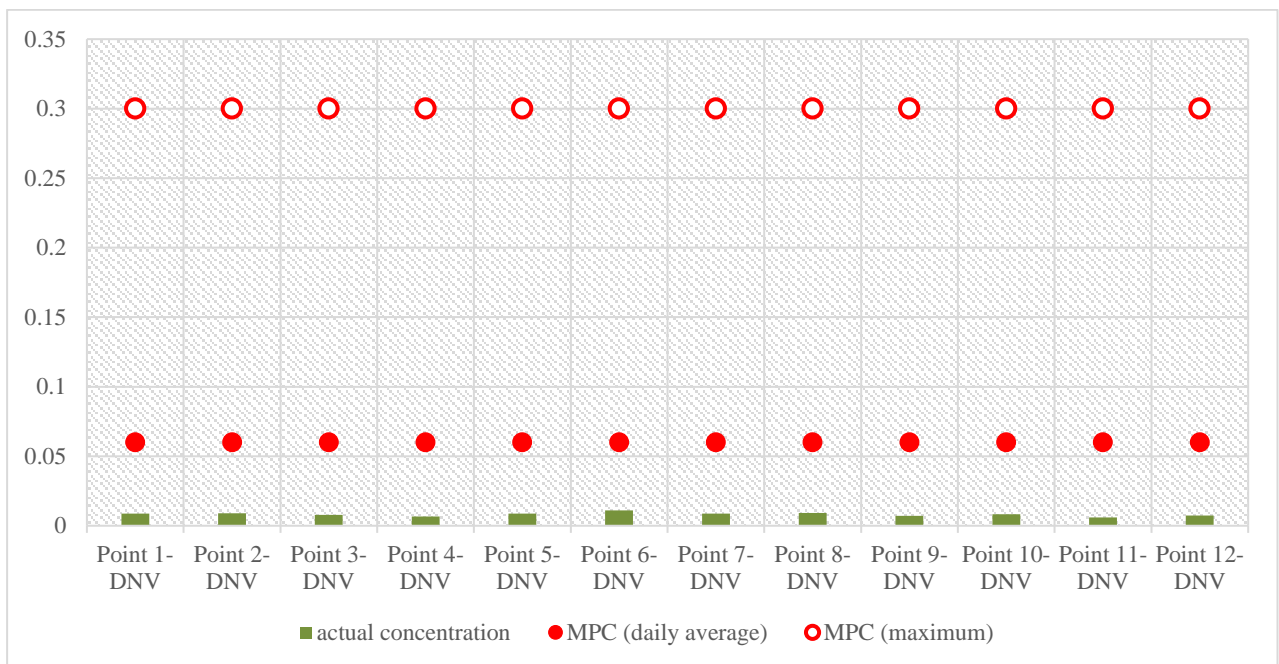


Fig. 15. Diagram of equivalent and maximum noise actual values at sensitive points compared with TLVs, dBA

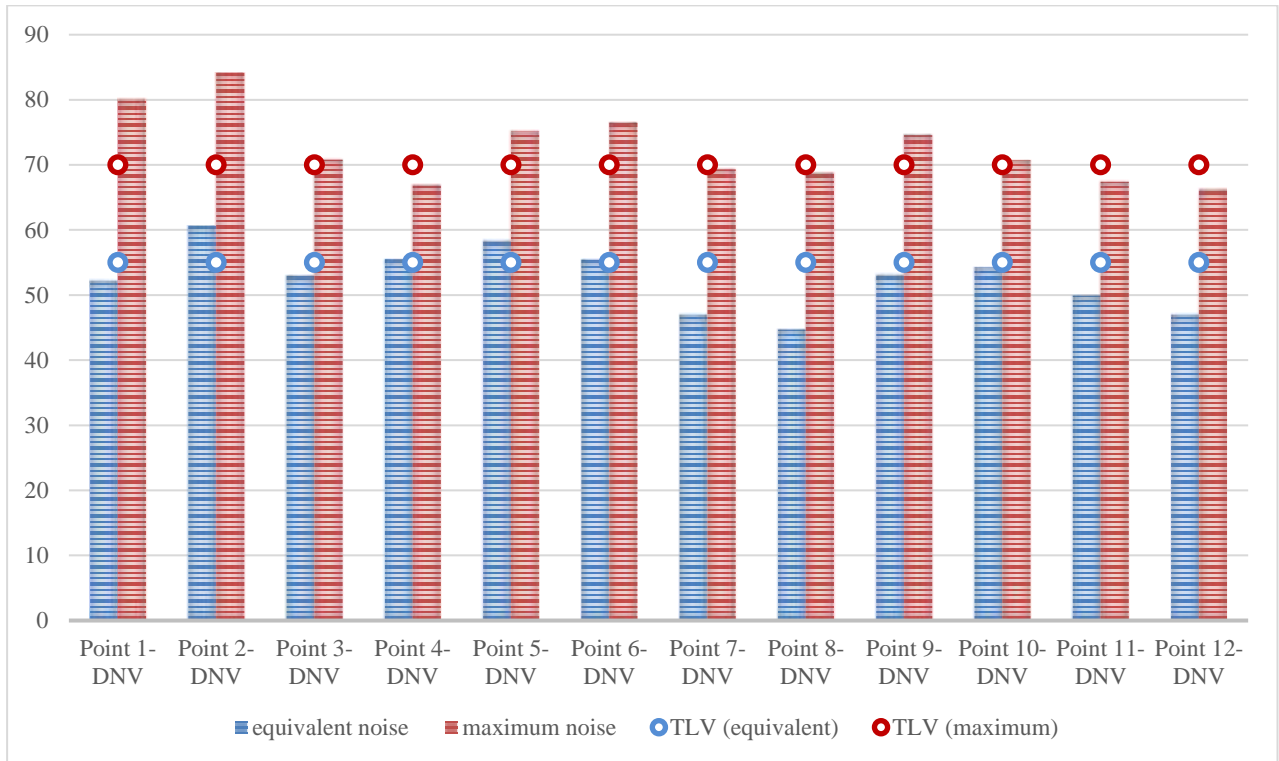
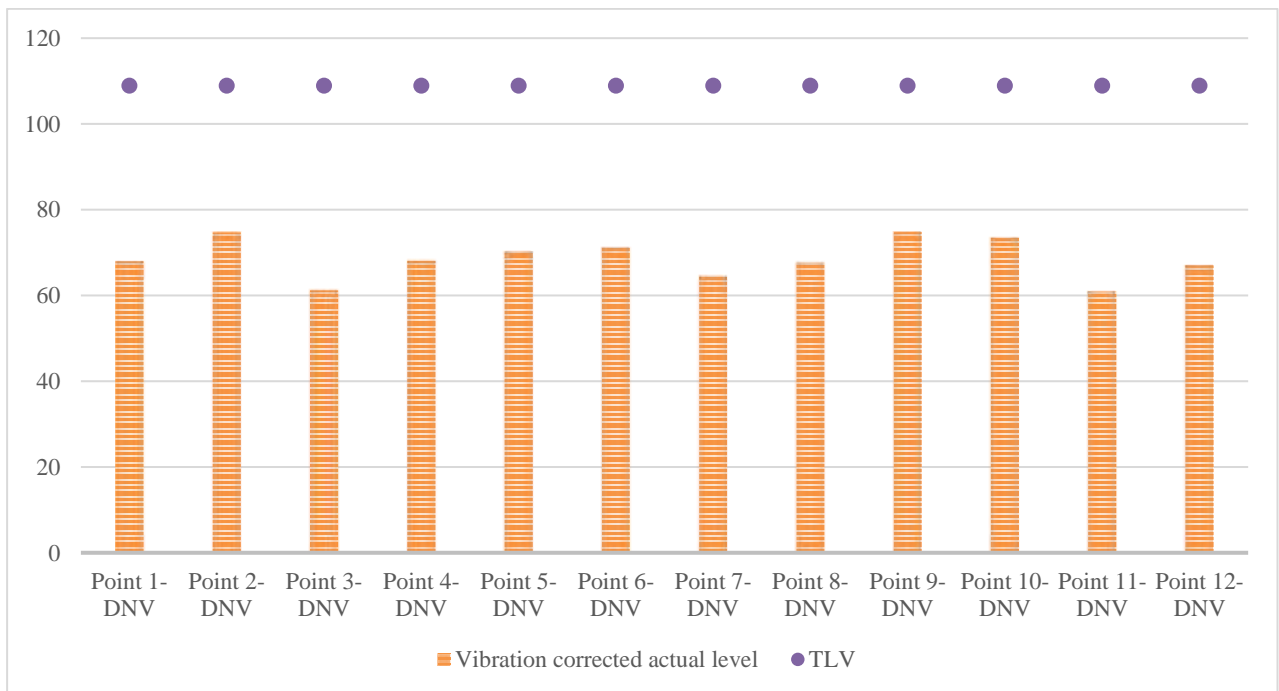


Fig. 16. Diagram of vibration actual values at sensitive points compared with the TLV set for (transport-technological) 2nd category, dB





5.2 Water Quality

The results of the chemical analysis of 9 water samples taken from the water bodies located within the Project influence area are given in [Table 10](#), while their comparisons with the water quality environmental norms for the Megri River water basin and water quality classes set by the RA Government Decree №-75-N are summarized in [Table 11](#).

Table 10. The results of the water chemical analysis sampled from the 9 points

№	Analysed parameters	Units	Results of the chemical analysis									Used standard method
			Water-1	Water-2	Water-3	Water-4	Water-5	Water-6	Water-7	Water-8	Water-9	
1	Colour	degree	10	10	10	5	5	10	10	10	15	ISO 7887
2	Odour	grade	0	0	1	0	0	0	0	0	0	РД 52.24.496-2005
3	Transparency	sm	31	31	31	31	31	31	31	31	31	ISO 7027
4	TSS	mg/l	1.3	1.9	19.0	2.9	7.5	3.3	2.4	7.0	36.6	ISO 11923
6	pH	-	7.3	7.8	7.9	7.9	7.8	7.8	7.6	7.7	7.8	ISO 10523
7	Mineralization	mg/l	120	192	232	233	298	167	150	165	288	ISO 7888
8	Specific electrical conduction	μS/cm ²	185	296	357	359	458	257	230	253	443	
9	BOD ₅	mgO ₂ /l	2.09	2.16	2.11	2.03	2.05	2.09	1.81	2.07	1.87	ISO 5815-1
10	COD	mgO/l	10	10	10	5	5	10	15	10	10	ISO 6061
11	Phosphates	mg/l	<0.01	0.0285	<0.01	<0.01	0.157	0.0285	0.0285	0.0143	0.128	ISO 6878
12	Carbonates	mg/l	6.0	10.5	12.0	12.0	15.0	10.5	9.0	9.0	15.0	ISO 9963-2
13	Sulphates	mg/l	35.40	33.29	42.66	41.33	35.58	33.11	31.41	33.30	47.79	ISO 10304-1
14	Chlorides	mg/l	1.68	5.98	6.99	6.35	8.75	5.32	5.24	5.44	10.07	
15	Nitrates	mg/l	1.31	1.21	1.30	1.24	3.03	0.713	1.04	0.917	6.40	
16	Fluorides	mg/l	<0.03	0.0301	<0.03	0.0367	<0.03	<0.03	<0.03	<0.03	<0.03	
17	Bromides	mg/l	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	



Table 11. Water quality classes of surface water bodies of the Meghri River basin determined as per the Table 6 for the analysed parameters of 9 water samplings

№	Analysed parameters	Ջրային օբյեկտների սմուշաման կետերում ջրի որակի կարգը (1-ից 5)								
		Water-1	Water-2	Water-3	Water-4	Water-5	Water-6	Water-7	Water-8	Water-9
1	Colour	III	III	III	II	II	III	III	III	III
2	Odour	I	I	I	I	I	I	I	I	I
3	Transparency	N/A								
4	TSS	I	I	IV	I	II	I	I	I	V
6	pH	N/A								
7	Mineralization	I	II	II	II	II	II	I	II	II
8	Specific electrical conduction	I	II	II	II	II	II	I	II	II
9	BOD ₅	I	I	I	I	I	I	I	I	I
10	COD	I	I	I	I	I	I	II	I	I
11	Phosphates	I	I	I	I	III	I	I	I	III
12	Carbonates	N/A								
13	Sulphates	III	II	III	III	III	II	II	II	III
14	Chlorides	I	I	I	I	I	I	I	I	II
15	Nitrates	II	II	II	II	III	II	II	II	IV
16	Fluorides	N/A								
17	Bromides	N/A								



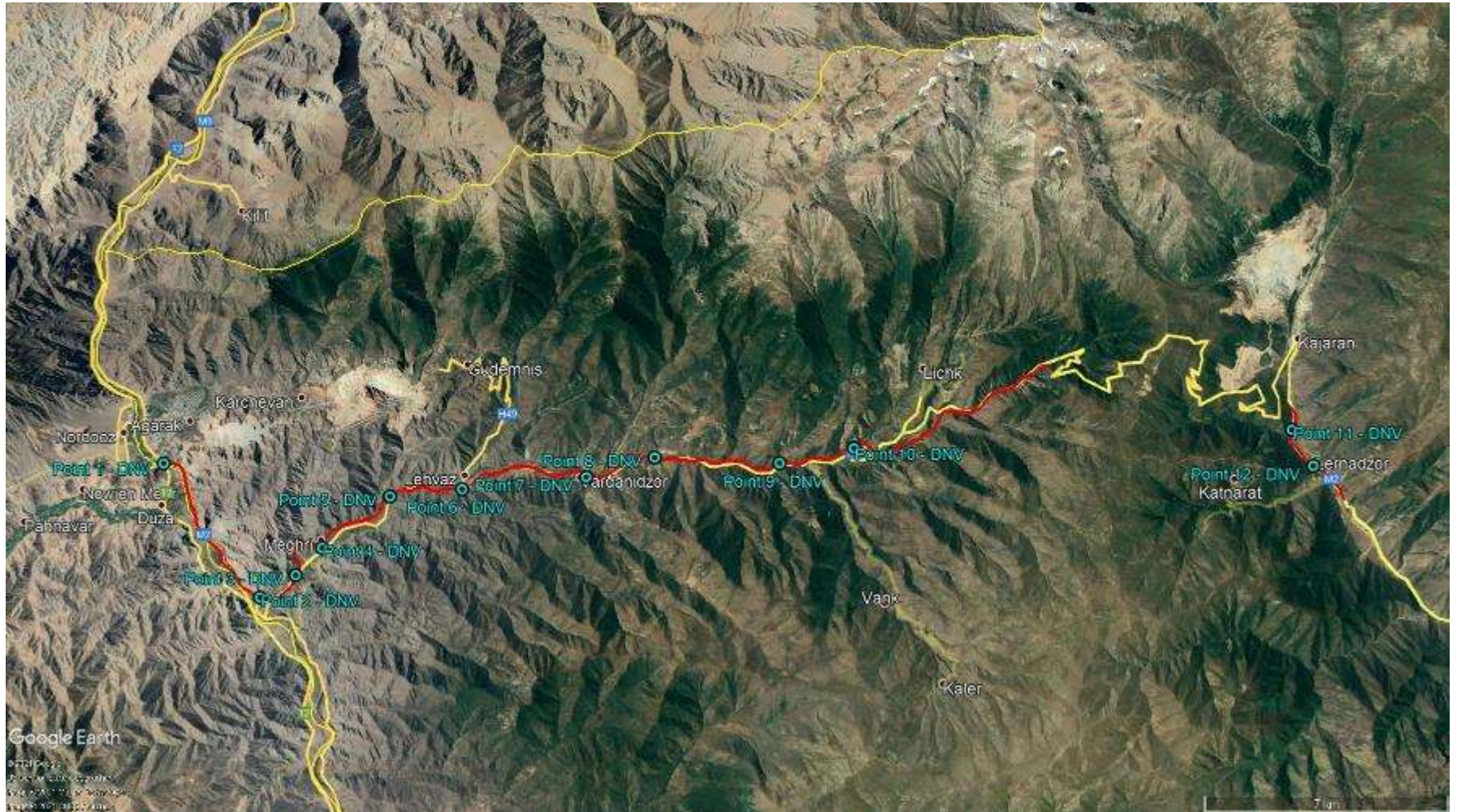
6. Conclusions

- 1) All 12 dust, noise and vibration instrumental measurement points are located within the residential areas or near the residential houses. Therefore, 55 dBA equivalent and 70 dBA maximum TLVs (see [Table 3](#)) for the assessment of noise actual levels shall be applied.
- 2) The actual equivalent noise/sound values at "Point-2 DNV" and "Point-5 DNV" were above, at "Point-4 DNV" and "Point-6 DNV" were equal, while at other measurement points were below the 55 dBA TLV set by the RA sanitary norms for the areas adjacent to the residential houses.
- 3) The actual maximum noise/sound values at "Point-1 DNV", "Point-2 DNV", "Point-3 DNV", "Point-5 DNV", "Point-6 DNV" and "Point-9 DNV" were above, while at other measurement points were below the 70 dBA TLV set by the RA sanitary norms for the areas adjacent to the residential houses.
- 4) The main noise sources at all 12 measurement points within the Project influence area are the transportation means moving along the road.
- 5) At all 12 measurement points the actual concentrations of PM_{2.5} and PM₁₀ (2.5 µm and 10 µm particles respectively) during the different periods of day-time didn't exceed the daily average and maximum permissible concentrations for residential areas set by the RA Government Decree № 160-N.
- 6) At all 12 measurement points the actual values of corrected and equivalent corrected values of vibration acceleration during the different periods of day-time didn't exceed the 109 TLV sets for the transport-technological (2nd category) vibration.



Annex 1

Map of dust, noise and vibration measurement points





Annex 2

Map of water sampling points





Annex 3

Verification certificates of dust, noise and vibration measurement devices

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԷԿՈԼՈՂԻԱԿԱՅԻ ԼԱՍԱՐԱՎՈՒԹՅԱՆ «ԱՍՏՆԱՐՄԱՐՏԱՑՄԱՆ ԵՎ ՉԱՓԱԳԻՏՈՒԹՅԱՆ ԱՅԳԱՅԻՆ ԱՄՐՄԻՆ» ՓԲ

ՍՏՈՒԳԱԶՈՒՓՄԱՆ ՎԿԱՅԱԿԱՆ № 034163

Ատուզաչափման րվաթյանը 2022թ. 08 և Ուժի մեջ է մտնել 2022թ. 08 և

Գործարանային հմ. *Սոյունի քարամշակման արտադրանքային գործարան*
283578

Տեսակը *Շինարարական*

Չափման տիրույթը *Շին. - Բ - 200000 կգ քար (0,5 x 1,25 x 1,30) ԳԲ*

Ճշտության դասը, կարգը (սխալանքը) *± 2 ԳԲ ± 0,3 ԳԲ*

Արտադրողը *Պ. Պ.*

Պատկանում է *«ՅՂ ՊԻ ԶՆ ԵՎ ՅՈՒ Արտադրանքային ԳՐ»*

Ատուզաչափման արդյունքների հիման վրա չափման միջոցը բավարարում է սահմանված պահանջներին:

Ատուզաչափումը կատարվել է համաձայն *ՍՏՔԿ 433150-00*

Ատուզաչափող *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Ատուզաչափման դրոշմի արտատիպը *ՍՏՔԿ 433150-00*

Քամին (չարորատրոֆայի վարիչ) *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Քառասունվեց է ԳՐ տեղեկագրի զարգացման և ներդրումների նախարարի 18.02.2018թ. թիվ 133-Ն հրամանով

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԷԿՈԼՈՂԻԱԿԱՅԻ ԼԱՍԱՐԱՎՈՒԹՅԱՆ «ԱՍՏՆԱՐՄԱՐՏԱՑՄԱՆ ԵՎ ՉԱՓԱԳԻՏՈՒԹՅԱՆ ԱՅԳԱՅԻՆ ԱՄՐՄԻՆ» ՓԲ

ՍՏՈՒԳԱԶՈՒՓՄԱՆ ՎԿԱՅԱԿԱՆ № 034161

Ատուզաչափման րվաթյանը 2022թ. 08 և Ուժի մեջ է մտնել 2022թ. 08 և

Գործարանային հմ. *Սոյունի քարամշակման արտադրանքային գործարան*
41/4 (46581)

Տեսակը *Մ.Ս.1361*

Չափման տիրույթը *(30 x 130) ԳԲ; (3,15 x 8,50) ԳԲ*

Ճշտության դասը, կարգը (սխալանքը) *± 1,5 ԳԲ*

Արտադրողը *Վիճարարական*

Պատկանում է *«ՅՂ ՊԻ ԶՆ ԵՎ ՅՈՒ Արտադրանքային ԳՐ»*

Ատուզաչափման արդյունքների հիման վրա չափման միջոցը բավարարում է սահմանված պահանջներին:

Ատուզաչափումը կատարվել է համաձայն *ՍՏՔԿ 8.257-*

Ատուզաչափող *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Ատուզաչափման դրոշմի արտատիպը *ՍՏՔԿ 8.257-*

Քամին (չարորատրոֆայի վարիչ) *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Քառասունվեց է ԳՐ տեղեկագրի զարգացման և ներդրումների նախարարի 18.02.2018թ. թիվ 133-Ն հրամանով

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԷԿՈԼՈՂԻԱԿԱՅԻ ԼԱՍԱՐԱՎՈՒԹՅԱՆ «ԱՍՏՆԱՐՄԱՐՏԱՑՄԱՆ ԵՎ ՉԱՓԱԳԻՏՈՒԹՅԱՆ ԱՅԳԱՅԻՆ ԱՄՐՄԻՆ» ՓԲ

ՍՏՈՒԳԱԶՈՒՓՄԱՆ ՎԿԱՅԱԿԱՆ № 033950

Ատուզաչափման րվաթյանը 2022թ. 08 և Ուժի մեջ է մտնել 2022թ. 08 և

Գործարանային հմ. *Վոլգա արտադրանքային (գոթ. համալիր) արտադրանքային գործարան*
3642603

Տեսակը *ՈՒ-Տ ՌԱՐ Դ*

Չափման տիրույթը *(0 x 9,999) ԳԲ*

Ճշտության դասը, կարգը (սխալանքը) *± 10%*

Արտադրողը *Վոլգա արտադրանքային*

Պատկանում է *«ՅՂ ՊԻ ԶՆ ԵՎ ՅՈՒ Արտադրանքային ԳՐ»*

Ատուզաչափման արդյունքների հիման վրա չափման միջոցը բավարարում է սահմանված պահանջներին:

Ատուզաչափումը կատարվել է համաձայն *ՍՏՔԿ 433150-00*

Ատուզաչափող *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Ատուզաչափման դրոշմի արտատիպը *ՍՏՔԿ 433150-00*

Քամին (չարորատրոֆայի վարիչ) *Ս. Մ. Կարամյան* *Ս. Մ. Կարամյան*

Քառասունվեց է ԳՐ տեղեկագրի զարգացման և ներդրումների նախարարի 18.02.2018թ. թիվ 133-Ն հրամանով



ANNEX 15: WRITINGS ABOUT TREE PLANTING AREAS AND DUMPING SITES



Contract T4-CS-01-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

Date: 28/07/2021
Ref: ARM007/21-117
To: IRA Syunik Region Meghri Community

Ամսաթիվ՝ 28/07/2021
Համար՝ ARM007/21-117
Հասցեագրված է՝ ՀՀ Արարատ մարզի Մեղրի համայնք

Mr. Ararat Tumanyan,
Community Head

Հանայնքի ղեկավար
պրն. Արարատ Թումանյանին

CC to: Road Department State Non-Commercial Organization (SNCO)
Government Building 3, 1st Floor, Republic Square 0010 – Yerevan, Republic of Armenia

Պատմենը՝ «Ճանապարհային դեպարտամենտ» ՊՈԱԿ
Կառավարական ՌՅ մասնաշենք, 1-ին հարկ, Հանրապետության հրապարակ, 0010 Երևան, ՀՀ

Attn. Mr. Stepan Machyan
Acting General Director

Գլխավոր տնօրենի ժամանակավոր պաշտոնակատար
պրն. Ստեփան Սաչյանին

Mr. Karen Badalyan
Project Director

Ծրագրի ղեկավար
պրն. Կարեն Բադալյանին

Contract: T4-CS-01-D, Qajaran/Agarak (Tranche 4)

Պայմանագիր՝ T4-CS-01-D, Քաջարան/Ագարակ (Տրանշ 4)

Subject: Landfills and tree planting areas

Թեմա՝ Լցակայաների և ծառայնկման տարածք

Reference: N/A

Հղում՝ N/A

Dear Mr. Tumanyan,

Հարգելի պարոն Թումանյան

Please, be informed that the North-South Road Corridor Investment Program: Tranche 4, Qajaran-Agarak section project design prepared by "IRD ENGINEERING S.R.L. – GP Ingegneria S.R.L." authorized by the "Road Department" SNCO of the Ministry of Territorial Administration and Infrastructure, is at the final stage.

Տեղեկացնում եմ, որ Հյուսիս-Հարավ ճանապարհային մշակման ներդրումային ծրագրի շրջանակներում՝ Տարածային կառավարման և ենթակառուցվածքների նախարարության «Ճանապարհային դեպարտամենտ» ՊՈԱԿ-ի կողմից ժառողված «Ապես Էնջինիլիեզ Ս.Ա.Ա և Այ-Ար-Դի Ինջինիլիեզ Ս.Ր.Լ.» ՀԳ-ի կողմից իրականացվող Հյուսիս-Հարավ ճանապարհային միջանցքի ներդրումային ծրագրի՝ Տրանշ 4, Քաջարան-Ագարակ ճանապարհամասովանի նախագիծը պետքում է ավարտական փուլում։ Նշված ծրագրի իրականացման շրջանակներում անհրաժեշտ են հետևյալ տարածքները։
- Տարածք՝ ջրավայր(երի) համար,
- Տարածք՝ ծառայնկման համար,

- The following areas are needed within the framework of the mentioned project:
- Area for the landfill (dump sites),
 - Area for tree planting

Based on the negotiations with the community and the research conducted together with representatives of the community, preliminary agreements were reached, as well as information on the listed areas was compiled. Attached are the maps of the areas identified as a result of the above-mentioned research in the territory of Kajaran community. Please, confirm the availability of the mentioned areas and / or make suggestions.

Հանայնքի հետ իրականացված բանակցությունների, ինչպես նաև համայնքի ներկայացուցիչների ուղեկցությամբ կատարված հետազոտությունների և ուսումնասիրությունների կիման վրա մեզ են քննվել նախնական համաձայնություններ, ինչպես նաև տեղեկատվություն թվարկված տարածքների վերաբերյալ։ Կից ներկայացնում եմ վերոբերյալ հետազոտությունների արդյունքում՝ Քաջարան համայնքի տարածքում նույնպես նշված տարածքների քարտեզները։ Խնդրում եմ հաստատել նշված տարածքների հասանելիությունը և/կամ կատարել առաջարկություններ։



Yours faithfully,

Fabio Buonomo
Consultant's Authorized Representative

Attachments:

1. Area for the landfill (dump sites) (soft copy)
2. Area for tree planting (soft copy)

Հարգանքով

Տարգիս Քոնոնյան
Խորհրդատուի փազոր ներկայացուցիչ

Աղոյիք՝

- Տարածք՝ լցակայանի(երի) համար (էլ. կրիչ)
- Տարածք՝ ձառանկվման համար (էլ. կրիչ)

Below area presented the maps of areas intended for dump sites, tree planting and topsoil stockpiling in Meghri community:

Լցակայանի, ձառանկվման և սևահողի պահեստման համար նախատեսված տարածքները Մեղրի համայնքի տարածքում ներկայացված քարտեզները:



Լկ 1: Տարածք - 1, լցակայանի լուսանկարը՝ Google Earth ծրագրով

Picture: Tashtun 1, dump site area (Google Earth program)



Նկ 2: Լցակայան Մեղրի – այգի և Լցակայան մեղրու գերեզմանոց – հանդիսատ, լուսանկարը՝ Google Earth ծրագրի լուսանկարով

Picture: Dump sites “Meghri – cemetery orchards” and “Ravine of the Meghri cemetery” (Google Earth program)



Նկ 3: Լցակայան Արաքսաշեն – 1, Արաքսաշեն-2 և Արաքսաշեն – 3, լուսանկարը՝ Google Earth ծրագրով

Picture: Dump sites Araksashen-1, Araksashen-2 and Araksashen-3 (Google Earth program)



Below are presented areas for afforestation / reforestation in Meghri community (Google Earth program). In these areas it is recommended to organize tree planting with species like oak, ash, pine (in first part) and Platanus orientalis (second part).



Նկ 4: Անտառուղեման/անտառախրականգնման առաջարկվող տեղամասերի լուսանկարները Google Earth ծրագրով: Այս տեղամասերում առաջարկվում է անտառատնկում իրականացնել իմնականում կաղնու, հացենու, սոճու ծառատեսակներով:



Նկ 5: Անտառուղեման/անտառախրականգնման առաջարկվող տեղամասերի լուսանկարները Google Earth ծրագրով: Այս տեղամասերում առաջարկվում է անտառատնկում իրականացնել Սոսի արևելյան ծառատեսակներով:



Below is presented reply from Meghri community to IRD Engineering (Fabio Buonomo) confirming their no objection about areas intended for dump sites, tree planting and topsoil stockpiling in Meghri community:



**ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ՍՅՈՒՆԻՔԻ ՄԱՐԶԻ
ՄԵՂՐԻԻ ՀԱՄԱՅՆՔԱՊԵՏԱՐԱՆ**

Հայաստանի Հանրապետության Մյուսիջի մարզի Մեղրի համայնք
Գր. Այուսիջի մարզ. ք. Մեղրի Զ. Մկրտչյանի 2, Գեո. +374 286 4-34-
23, +374 286 4-35-00, meghri.syunic@mta.gov.am

N Ե-1191
01 սեպտեմբեր 2021թ.

**ԻՌԴ ԻՆՋԻՆԵՐԻՆԳ
ԽՈՐՀՐԴԱՏՈՒԻ ԼԻԱԶՈՐ
ՆԵՐԿԱՅԱՑՈՒՑԻՉ
ԲՈՒՈՆՈՄՈ ՖԱԲԻՈՆ**

Հարգելի պարոն Բուոնոմո Ֆաբիո

Ի պատասխան Ձեր 28/07/2021թ. թիվ ARM007/21-117 գրության տեղեկացնում ենք Ձեզ, որ Մեղրի համայնքի հետ իրականացված բանակցությունների, ինչպես նաև համայնքի ներկայացուցիչների ուղեկցությամբ կատարված հետազոտությունների և ուսումնասիրությունների հիման վրա ձեռք բերված համաձայնությունների՝ լցակայանների և ծառատնկման տարածքների վերաբերյալ առարկություն և առաջարկություններ չունի:



ՀԱՄԱՅՆՔԻ ՂԵԿԱՎԱՐԻ ՊԱՇՏՈՆԱԿԱՏԱՐ՝ ԱՐԱՐԱՏ ԹՈՒՄԱՆՅԱՆ

Կարգ. Բաղդասարյան, Խոջոպազյան, Գրիշապետյան, Գրիշի կառավարման բաժնի պետ/պր. մասնագետ/ Հ. Հովսեփյան
0286-4-35-00



Contract T4-CS-01-D: Preparation of Detailed Design, Land Acquisition and Resettlement Plan and Implementation of Author Supervision of about 32 km road from Agarak to tunnel exit; and Preparation of Detailed Design, Land Acquisition and Resettlement Plan of about 7 km road from tunnel entrance to Qajaran and about 6 km of the tunnel and access roads (Tranche 4)

Date: 28/07/2021
Ref: ARM007/21-116
To: IRA Syunik Region Kajaran Community

Mr. Manvel Paramazyan,
Community Head

CC to: Road Department State Non-Commercial Organization (SNCO)
Government Building 3, 1st Floor, Republic Square 0010 – Yerevan, Republic of Armenia

Attn. Mr. Stepan Machyan
Acting General Director

Mr. Karen Badalyan
Project Director

Contract: T4-CS-01-D, Qajaran/Agarak (Tranche 4)

Subject: Landfills and tree planting areas

Reference: N/A

Dear Mr. Paramazyan,

Please, be informed that the North-South Road Corridor Investment Program: Tranche 4, Qajaran-Agarak section project design prepared by "IRD ENGINEERING S.R.L. – GP Ingegneria S.R.L." authorized by the "Road Department" SNCO of the Ministry of Territorial Administration and Infrastructure, is at the final stage

The following areas are needed within the framework of the mentioned project:

- Area for the landfill (dump sites),
- Area for tree planting

Based on the negotiations with the community and the research conducted together with representatives of the community, preliminary agreements were reached, as well as information on the listed areas was compiled. Attached are the maps of the areas identified as a result of the above-mentioned research in the territory of Kajaran community. Please, confirm the availability of the mentioned areas and / or make suggestions.

Ամսաթիվ՝ 28/07/2021
Համար՝ ARM007/21-116
Հասցեագրված է՝ ՀՀ Այրտիքի մարզի Քաջարան
Խամայնջ
Համայնքի ղեկավար
պրն. Մանվել Փարամազյանին

Պատճեններ՝ «Ճանապարհային ղեկավարամենտ» ՊՈԱԿ
Կառավարական N3 մասնաշենք, 1-ին հարկ,
Հանրապետության հրապարակ, 0010 Երևան, ՀՀ

Գլխավոր տնօրենի ժամանակավոր պաշտոնակատար
պրն. Ստեփան Մաչյանին
Ծրագրի ղեկավար՝
պրն. Կարեն Բաղդասյանին

Պայմանագիր՝ T4-CS-01-D, Քաջարան/Ագարակ (Տրանշ
-4)
Թեմա՝ Լցակայանների և ծառատնկման տարածք

Հղում՝ N/A

Հարգելի պարոն Փարամազյան

Տեղեկացնում եմ, որ Հյուսիս Հարավ ճանապարհային մշանցքի ներդրումային ծրագրի շրջանակներում՝ Տարածքային կառավարման և ենթակառուցվածքների նախարարության «Ճանապարհային ղեկավարամենտ» ՊՈԱԿ-ի կողմից լիցենզիավորված «Ապեա Էնջինիրինգ Ա.ս.ս. և Այ-Ար-Դի Ինջինիրինգ Ա.ր.լ.» ՀճԻ կողմից իրականացվող Հյուսիս-Հարավ ճանապարհային միջանցքի ներդրումային ծրագիր՝ Տրանշ 4, Քաջարան-Ագարակ ճանապարհահատվածի նախագիծը գտնվում է ավարտական փուլում:

Ելված ծրագրի իրականացման շրջանակներում անհրաժեշտ են հետևյալ տարածքները.

- Տարածք՝ լցակայանների համար,
- Տարածք՝ ծառատնկման համար.

Համայնքի հետ իրականացված քանակազրկությունների, ինչպես նաև համայնքի ներկայացուցիչների ուղեկցությամբ կատարված հետազոտությունների և տարանախփությունների հիման վրա ձեռք են բերվել նախնական համաձայնություններ, ինչպես նաև տեղեկատվություն թվարկված տարածքների վերաբերյալ:

Կից ներկայացնում եմ վերոպայլ հետազոտությունների արդյունքում Քաջարան համայնքի տարածքում նույնականացված տարածքների լցարևակները. ինչպես նաև հաստատել ելված տարածքների հասանելիությունը և/կամ կատարել անաշարկություններ:



Yours faithfully,

Fabio Buonomo
Consultant's Authorized Representative

Attachments:

1. Area for the landfill (dump sites) (soft copy)
2. Area for tree planting (soft copy)

Հարգանքով,

Ֆաբիո Բուոնոմո
Խորհրդատվի լիազոր ներկայացուցիչ

Աղյուսակ

1. Տարածք՝ լրացուցիչ(վերին) համար (ԼԼ կրիչ)
2. Տարածք՝ ծառատնկման համար (ԵՂ կրիչ)



Below area presented the maps of areas intended for dump sites, tree planting and topsoil stockpiling in Kajaran community:

Լցակայաների, ծառատնկման և սևահողի պահպանման համար նվազագույն խառնուրդով հարմարագույն տարածքները Բաջարան համայնքի տարածքում ներկայացված բարեբերների տեսքով:



Նկ 1: Լցակայաների առաջարկվող տեղադիրքերի լուսանկարը Google Earth ծրագրով

Picture: The areas intended for dump sites (Google Earth program)



Նկ 2: Ծառատնկման անաչարևվող տնդարկիցի լուսանկարը - Google Earth ծրագրով

Picture: The areas intended for tree planting (Google Earth program)



Below is presented reply from Kajaran community (M. Pharamazyan) to IRD Engineering (Fabio Buonomo) confirming their no objection about areas intended for dump sites, tree planting and topsoil stockpiling in Kajaran community:



ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
ՍՅՈՒՆԻՔԻ ՄԱՐԶ
ՔԱՋԱՐԱՆԻ ՀԱՄԱՅՆՔԱԴՐՈՒԹՅԱՐԱՆ

Հայաստանի Հանրապետության Այտնիքի մարզի Քաջարան համայնք

«Հ. Այտնիքի մարզ» ք. Քաջարան Լեռնաշենքի 4, 0265-3 21-81, kajaran@mta.gov.am, kajaran_syunik@mta.gov.am

№ - 667

«31» Օգոստոսի 2021թ.

«ԱՅԵՆԻՂԻ ԵՆՅԻՆԻՐԻՆԳՆՐՈՒՄ և «Ջ.Պ. ԻնՅԻՆԵՐԻԱ ՍՐԸ» ՀԶ խորհրդատուի լիազոր ներկայացուցիչ Ֆաբիո Բուոնոմոյին

Ի պատասխան Ձեր 28.07.2021թ № ARM007/21-116 զրույցյան

Հյուսիս - Հարավ ճանապարհային միջանցքի ներդրումային ծրագրի «Տրանշ 4, Քաջարան - Լեզարակ» ենթածրագրի իրականացման համար անհրաժեշտ՝ նախատես համաձայնեցված ծառատնկման տարածքի հասանելիությունը հաստատում ենք:

Լցակայան(երի) համար նախորոշված տարածքների վերաբերյալ մեր նախնական համաձայնությունը հաստատում ենք: Կարծում ենք՝ աշխատանքները սկսելու դեպքում (լցակայան(երի) տարածքների վերաբերյալ շահագրգիռ այլ կողմերի հետ լրացուցիչ համաձայնեցումների անհրաժեշտություն կլինի:

Հարգանքով՝

/ Համայնքի ղեկավար՝

Մ.Փարամազյան



ANNEX 16: CALCULATIONS OF TERRESTRIAL CONCENTRATIONS OF AIR POLLUTION

1. Общие сведения.

Расчет проведен на ПК "ЭРА" v3.0 фирмы НПП "Логос-Плюс", Новосибирск в соответствии с положениями документа "Методы расчетов рассеивания выбросов вредных (загрязняющих) веществ в атмосферном воздухе" (МРР-2017).
Расчет выполнен ООО "Консекоард" (Consecoard LLC)

| Заключение экспертизы Министерства природных ресурсов и Росгидромета |
на программу: письмо № 140-09213/20и от 30.11.2020

2. Параметры города

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Название: Каджаран

Коэффициент А = 200

Скорость ветра U_{mr} = 25.0 м/с (для лета 25.0, для зимы 12.0)

Средняя скорость ветра = 5.0 м/с

Температура летняя = 17.0 град.С

Температура зимняя = -3.2 град.С

Коэффициент рельефа = 1.50

Площадь города = 0.0 кв.км

Угол между направлением на СЕВЕР и осью X = 90.0 угловых градусов

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:29

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3



Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

Код	Реж	Тип	H1	H2	D	Wo	V1	T	X1	Y1	X2	Y2	Alf
000101	0001	1	P2	2.0	90.0	3.00	19085.2	17.0	0	0	90	90	0
1.0	1.500	1	0.0648000	0.000									

4. Расчетные параметры Cm, Um, Xm

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:29

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Источники													Их расчетные параметры		
Номер	Код	Режим	M	Тип	Cm	Um	Xm								
-п/п-	<об-п>	<ис>	-----	-----	-----	[доли ПДК]	[м/с]	[м]							
1	000101	0001	1	P2	0.022738	386.10	270.5								
			Суммарный Mq = 0.064800 г/с												
			Сумма Cm по всем источникам = 0.022738 долей ПДК												

Средневзвешенная опасная скорость ветра = 386.10 м/с															



Дальнейший расчет нецелесообразен: Сумма См < 0.05 долей ПДК

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:29

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

Код загр вещества	Штиль U<=2м/с	Северное направление	Восточное направление	Южное направление	Западное направление

Пост N 001: X=0, Y=0					
0301	0.0080000	0.0080000	0.0080000	0.0080000	0.0080000
	0.0400000	0.0400000	0.0400000	0.0400000	0.0400000

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

Средневзвешенная опасная скорость ветра U_{св}= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.



Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30
Примесь :0301 - Азота диоксид
ПДКм.р для примеси 0301 = 0.2 мг/м3

Расчет проводился на прямоугольнике 1
с параметрами: координаты центра X= -3, Y= 0
размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480
Запрошен учет дифференцированного фона с постов для действующих источников
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Uпр) м/с

Расшифровка_обозначений

Qc - суммарная концентрация [доли ПДК]
Cc - суммарная концентрация [мг/м.куб]
Cф - фоновая концентрация [доли ПДК]
Cф` - фон без реконструируемых [доли ПДК]
Cди- вклад действующих (для Cф`) [доли ПДК]
Фоп- опасное направл. ветра [угл. град.]
Uоп- опасная скорость ветра [м/с]

~~~~~  
| -Если в расчете один источник, то его вклад и код не печатаются|  
| -Если в строке Cmax=< 0.05 ПДК, то Фоп,Uоп,Ви,Ки не печатаются |  
~~~~~

y= 2400 : Y-строка 1 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=135)
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

y= 1920 : Y-строка 2 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра=135)



```

-----:
x= -2403 : -1923: -1443:  -963:  -483:   -3:  477:  957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= 1440 : Y-строка 3 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=239)

```

-----:
x= -2403 : -1923: -1443:  -963:  -483:   -3:  477:  957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= 960 : Y-строка 4 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=248)

```

-----:
x= -2403 : -1923: -1443:  -963:  -483:   -3:  477:  957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= 480 : Y-строка 5 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=101)

```

-----:
x= -2403 : -1923: -1443:  -963:  -483:   -3:  477:  957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

```



Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
 Cf : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cf` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

y= 0 : Y-строка 6 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Cf : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cf` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -480 : Y-строка 7 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 79)
 -----:
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
 Cf : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cf` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

y= -960 : Y-строка 8 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=292)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Cf : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:



Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

 у= -1440 : У-строка 9 Смах= 0.040 долей ПДК (х= 2397.0; напр.ветра=301)

 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

-----  
 у= -1920 : У-строка 10 Смах= 0.040 долей ПДК (х= -1923.0; напр.ветра= 45)  
 -----  
 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

 у= -2400 : У-строка 11 Смах= 0.040 долей ПДК (х= -2403.0; напр.ветра= 45)

 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Sc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~





Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
Расчет проводится в соответствии с документом МРР-2017  
Координаты точки : X= -2403.0 м, Y= 2400.0 м

Максимальная суммарная концентрация | Cs= 0.0400246 доли ПДКмр |  
| 0.0080049 мг/м3 |  
~~~~~

Достигается при опасном направлении 135 град.
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада
ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Коэф. влияния
----	<Об-П>	<Ис>	-----	--- ---М- (Мг) --	-С [доли ПДК]	-----	-----	---- b=C/M ---
	Фоновая концентрация Cf`				0.039984	99.9	(Вклад источников 0.1%)	
1	000101	0001	1	П2	0.000041	100.0	100.0	0.000633089
	В сумме =				0.040025	100.0		

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые
Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30
Примесь :0301 - Азота диоксид
ПДКм.р для примеси 0301 = 0.2 мг/м3

Параметры_расчетного_прямоугольника_No 1
| Координаты центра : X= -3 м; Y= 0 |
| Длина и ширина : L= 4800 м; В= 4800 м |
| Шаг сетки (dX=dY) : D= 480 м |
~~~~~



Запрошен учет дифференцированного фона с постов для действующих источников  
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

|     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| *   |       |       |       |       |       |       |       |       |       |       |       |      |
| 1-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 1    |
| 2-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 2    |
| 3-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 3    |
| 4-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 4    |
| 5-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 5    |
| 6-С | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | С- 6 |
| 7-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 7    |
| 8-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 8    |
| 9-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 9    |
| 10- | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 10   |
| 11- | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 11   |
|     |       |       |       |       |       |       |       |       |       |       |       |      |
|     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |

В целом по расчетному прямоугольнику:

Максимальная концентрация -----> С<sub>м</sub> = 0.0400246 долей ПДК<sub>мр</sub>  
= 0.0080049 мг/м<sup>3</sup>



Достигается в точке с координатами:  $X_m = -2403.0$  м  
( X-столбец 1, Y-строка 1)  $Y_m = 2400.0$  м  
При опасном направлении ветра : 135 град.  
и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Точка 1. Расчетная точка.

Координаты точки :  $X = -618.0$  м,  $Y = -524.0$  м

Максимальная суммарная концентрация | Cs= 0.0400235 доли ПДК<sub>мр</sub> |  
| 0.0080047 мг/м3 |

Достигается при опасном направлении 50 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код         | Режим | Тип | Выброс                   | Вклад         | Вклад в%                     | Сум. % | Козф. влияния |
|------|-------------|-------|-----|--------------------------|---------------|------------------------------|--------|---------------|
| ---- | <Об-П>-<Ис> | ----- | --- | М- (М <sub>г</sub> )     | -С [доли ПДК] | -----                        | -----  | b=C/M ---     |
|      |             |       |     | Фоновая концентрация Cf` | 0.039984      | 99.9 (Вклад источников 0.1%) |        |               |
| 1    | 000101 0001 | 1     | П2  | 0.0648                   | 0.000039      | 100.0                        | 100.0  | 0.000604762   |
|      |             |       |     | В сумме =                | 0.040024      | 100.0                        |        |               |





3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|-----|
| F      | КР    | Ди  | Выброс    | RoГВС |       |       |         |        |       |         |         |         |         |     |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | гр. |
| ~~~    | ~~~   | ~~  | ~~~г/с~~~ | ~~~~~ |       |       |         |        |       |         |         |         |         |     |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 17.0   | 0     | 0       | 90      | 90      | 0       |     |
| 3.0    | 1.500 | 0   | 0.0066000 | 0.000 |       |       |         |        |       |         |         |         |         |     |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей площади, а См - концентрация одиночного источника, расположенного в



| центре симметрии, с суммарным M                              |             |       |          |       |                        |           |       |     |
|--------------------------------------------------------------|-------------|-------|----------|-------|------------------------|-----------|-------|-----|
| Источники                                                    |             |       |          |       | Их расчетные параметры |           |       |     |
| Номер                                                        | Код         | Режим | M        | Тип   | Cm                     | Um        | Xm    |     |
| -п/п-                                                        | <об-п>-<ис> | ----- | -----    | ----- | - [доли ПДК]           | -- [м/с]  | ----  | [м] |
| 1                                                            | 000101 0001 | 1     | 0.006600 | П2    | 0.009264               | 386.10    | 135.3 |     |
| Суммарный Mq =                                               |             |       | 0.006600 | г/с   |                        |           |       |     |
| Сумма Cm по всем источникам =                                |             |       |          |       | 0.009264               | долей ПДК |       |     |
| -----                                                        |             |       |          |       |                        |           |       |     |
| Средневзвешенная опасная скорость ветра = 386.10 м/с         |             |       |          |       |                        |           |       |     |
| -----                                                        |             |       |          |       |                        |           |       |     |
| Дальнейший расчет нецелесообразен: Сумма Cm < 0.05 долей ПДК |             |       |          |       |                        |           |       |     |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м3

Фоновая концентрация не задана

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Ump) м/с

Средневзвешенная опасная скорость ветра Uсв= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017



Город :041 Каджаран.  
Объект :0001 Строительная площадка.  
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
Примесь :0328 - Углерод  
ПДКм.р для примеси 0328 = 0.15 мг/м3

Расчет не проводился: См < 0.05 долей ПДК

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.  
Объект :0001 Строительная площадка.  
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
Примесь :0328 - Углерод  
ПДКм.р для примеси 0328 = 0.15 мг/м3

Расчет не проводился: См < 0.05 долей ПДК

10. Результаты расчета в фиксированных точках..

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.  
Объект :0001 Строительная площадка.  
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
Примесь :0328 - Углерод  
ПДКм.р для примеси 0328 = 0.15 мг/м3

Расчет не проводился: См < 0.05 долей ПДК

3. Исходные параметры источников.



ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Город :041 Каджаран.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
 Примесь :0330 - Серы диоксид  
 ПДКм.р для примеси 0330 = 0.5 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников  
 Коэффициент оседания (F): индивидуальный с источников

| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|-----|
| F      | КР    | Ди  | Выброс    | RoГВС |       |       |         |        |       |         |         |         |         |     |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | гр. |
| ~~~    | ~~~   | ~~  | ~~~г/с~~~ | ~~~~~ |       |       |         |        |       |         |         |         |         |     |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 17.0   | 0     | 0       | 90      | 90      | 0       |     |
| 1.0    | 1.500 | 1   | 0.0062000 | 0.000 |       |       |         |        |       |         |         |         |         |     |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Город :041 Каджаран.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
 Сезон :ЛЕТО (температура воздуха 17.0 град.С)  
 Примесь :0330 - Серы диоксид  
 ПДКм.р для примеси 0330 = 0.5 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей |  
 | площади, а См - концентрация одиночного источника, расположенного в |  
 | центре симметрии, с суммарным М |  
 | ~~~~~ |  
 | \_\_\_\_\_ Источники \_\_\_\_\_ | \_\_\_\_\_ Их расчетные параметры \_\_\_\_\_ |





| Номер                                         | Код         | Режим | М                  | Тип   | См             | Um          | Xm             |
|-----------------------------------------------|-------------|-------|--------------------|-------|----------------|-------------|----------------|
| -п/п-                                         | <об-п>-<ис> | ----- | -----              | ----- | - [доли ПДК] - | -- [м/с] -- | ---- [м] ----  |
| 1                                             | 000101 0001 | 1     | 0.006200           | П2    | 0.000870       | 386.10      | 270.5          |
| Суммарный Мq =                                |             |       | 0.006200 г/с       |       |                |             |                |
| Сумма См по всем источникам =                 |             |       | 0.000870 долей ПДК |       |                |             |                |
| Средневзвешенная опасная скорость ветра =     |             |       |                    |       |                |             | 386.10 м/с     |
| Дальнейший расчет нецелесообразен: Сумма См < |             |       |                    |       |                |             | 0.05 долей ПДК |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :0330 - Серы диоксид

ПДКм.р для примеси 0330 = 0.5 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

| Код загр             | Штиль     | Северное    | Восточное   | Южное       | Западное    |
|----------------------|-----------|-------------|-------------|-------------|-------------|
| вещества             | U<=2м/с   | направление | направление | направление | направление |
| Пост N 001: X=0, Y=0 |           |             |             |             |             |
| 0330                 | 0.0200000 | 0.0200000   | 0.0200000   | 0.0200000   | 0.0200000   |
|                      | 0.0400000 | 0.0400000   | 0.0400000   | 0.0400000   | 0.0400000   |

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Uмр) м/с



Средневзвешенная опасная скорость ветра  $U_{св} = 386.1$  м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0330 - Серы диоксид

ПДКм.р для примеси 0330 = 0.5 мг/м<sup>3</sup>

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра  $X = -3$ ,  $Y = 0$

размеры: длина (по X) = 4800, ширина (по Y) = 4800, шаг сетки = 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 ( $U_{мр}$ ) м/с

Расшифровка\_обозначений

|                                             |  |
|---------------------------------------------|--|
| Qс - суммарная концентрация [доли ПДК]      |  |
| Сс - суммарная концентрация [мг/м.куб]      |  |
| Сф - фоновая концентрация [ доли ПДК ]      |  |
| Сф` - фон без реконструируемых [доли ПДК ]  |  |
| Сди- вклад действующих (для Сф`) [доли ПДК] |  |
| Фоп- опасное направл. ветра [ угл. град.]   |  |
| Uоп- опасная скорость ветра [ м/с ]         |  |

```

|~~~~~|
| -Если в расчете один источник, то его вклад и код не печатаются|
| -Если в строке Смах=< 0.05 ПДК, то Фоп,Uоп,Ви,Ки не печатаются |
|~~~~~|

```

y= 2400 : Y-строка 1 Смах= 0.040 долей ПДК (x= -1923.0; напр.ветра=141)

```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:

```



Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= 1920 : Y-строка 2 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра=135)

-----:
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
 -----:
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

y= 1440 : Y-строка 3 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=121)

-----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= 960 : Y-строка 4 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=248)

-----:
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
 -----:
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:



Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

-----  
 у= 480 : У-строка 5 Смах= 0.040 долей ПДК (х= -2403.0; напр.ветра=101)  
 -----  
 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Sc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

 у= 0 : У-строка 6 Смах= 0.040 долей ПДК (х= -2403.0; напр.ветра= 90)

 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Sc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

-----  
 у= -480 : У-строка 7 Смах= 0.040 долей ПДК (х= -2403.0; напр.ветра= 79)  
 -----  
 х= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Sc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~




y= -960 : Y-строка 8 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=292)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

y= -1440 : Y-строка 9 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 59)  
-----  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----  
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
~~~~~

y= -1920 : Y-строка 10 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра= 45)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

y= -2400 : Y-строка 11 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра= 39)  
-----



```

x= -2403 : -1923: -1443:  -963:  -483:   -3:  477:  957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Координаты точки : X= -1923.0 м, Y= 2400.0 м

Максимальная суммарная концентрация | Cs= 0.0400009 доли ПДКмр |  
 | 0.0200005 мг/м3 |  
 ~~~~~

Достигается при опасном направлении 141 град.  
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код                      | Режим | Тип | Выброс   | Вклад         | Вклад в% | Сум. %                  | Кэф. влияния |
|------|--------------------------|-------|-----|----------|---------------|----------|-------------------------|--------------|
|      | <Об-П>-<Ис>              |       |     | М- (Мг)  | -С [доли ПДК] |          |                         | b=C/M        |
|      | Фоновая концентрация Cф` |       |     |          | 0.039999      | 100.0    | (Вклад источников 0.0%) |              |
| 1    | 000101 0001              | 1     | П2  | 0.006200 | 0.000002      | 99.9     | 99.9                    | 0.000252782  |
|      | В сумме =                |       |     |          | 0.040001      | 99.9     |                         |              |

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30  
 Примесь :0330 - Серы диоксид



ПДКм.р для примеси 0330 = 0.5 мг/м3

```

_____ Параметры_расчетного_прямоугольника_No 1 _____
| Координаты центра : X= -3 м; Y= 0 |
| Длина и ширина : L= 4800 м; В= 4800 м |
| Шаг сетки (dX=dY) : D= 480 м |
| ~~~~~~

```

Запрошен учет дифференцированного фона с постов для действующих источников  
 Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
 Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

|     | 1     | 2     | 3     | 4     | 5     | 6           | 7     | 8     | 9     | 10    | 11    |      |
|-----|-------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|-------|------|
| *-- | ----  | ----  | ----  | ----  | ----  | -----C----- | ----  | ----  | ----  | ----  | ----  | ---- |
| 1-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 1  |
| 2-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 2  |
| 3-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 3  |
| 4-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 4  |
| 5-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 5  |
| 6-C | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | C- 6 |
| 7-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 7  |
| 8-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 8  |
| 9-  | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 9  |
| 10- | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040       | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | -10  |



```

11-| 0.040 0.040 0.040 0.040 0.040 0.040 0.040 0.040 0.040 0.040 0.040 | -11
 |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
 | 1 2 3 4 5 6 7 8 9 10 11

```

В целом по расчетному прямоугольнику:

Максимальная концентрация ----->  $C_m = 0.0400009$  долей ПДК<sub>мр</sub>  
 $= 0.0200005$  мг/м<sup>3</sup>

Достигается в точке с координатами:  $X_m = -1923.0$  м  
 ( X-столбец 2, Y-строка 1)  $Y_m = 2400.0$  м

При опасном направлении ветра : 141 град.  
 и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0330 - Серы диоксид

ПДК<sub>м.р</sub> для примеси 0330 = 0.5 мг/м<sup>3</sup>

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Точка 1. Расчетная точка.

Координаты точки :  $X = -618.0$  м,  $Y = -524.0$  м

```

Максимальная суммарная концентрация | Cs= 0.0400009 доли ПДКмр |
0.0200005 мг/м3

```

Достигается при опасном направлении 50 град.  
 и скорости ветра 25.00 м/с





Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном.      | Код         | Режим | Тип | Выброс   | Вклад    | Вклад в% | Сум. % | Коеф. влияния |
|-----------|-------------|-------|-----|----------|----------|----------|--------|---------------|
| 1         | 000101 0001 | 1     | П2  | 0.006200 | 0.000001 | 99.9     | 99.9   | 0.000241905   |
| В сумме = |             |       |     |          | 0.040001 | 99.9     |        |               |

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м3

Кoeffициент рельефа (КР): индивидуальный с источников

Кoeffициент оседания (F): индивидуальный с источников

| Код         | Реж | Тип | H1  | H2 | D    | Wo   | V1      | T    | X1 | Y1 | X2 | Y2 | Alf |
|-------------|-----|-----|-----|----|------|------|---------|------|----|----|----|----|-----|
| 000101 0001 | 1   | П2  | 2.0 |    | 90.0 | 3.00 | 19085.2 | 17.0 | 0  | 0  | 90 | 90 | 0   |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.



Вар.расч. :1      Расч.год: 2021 (СП)      Расчет проводился 23.08.2021 20:30  
 Сезон :ЛЕТО (температура воздуха 17.0 град.С)  
 Примесь :0337 - Углерода оксид  
 ПДКм.р для примеси 0337 = 5.0 мг/м3

|                                                                                                                                                                             |             |       |              |                        |                    |              |          |         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------------|------------------------|--------------------|--------------|----------|---------|
| - Для линейных и площадных источников выброс является суммарным по всей площади, а Cm - концентрация одиночного источника, расположенного в центре симметрии, с суммарным M |             |       |              |                        |                    |              |          |         |
| ~~~~~                                                                                                                                                                       |             |       |              |                        |                    |              |          |         |
| Источники                                                                                                                                                                   |             |       |              | Их расчетные параметры |                    |              |          |         |
| Номер                                                                                                                                                                       | Код         | Режим | M            | Тип                    | Cm                 | Um           | Xm       |         |
| -п/п-                                                                                                                                                                       | <об-п>      | <ис>  | -----        | -----                  | -----              | - [доли ПДК] | -- [м/с] | --- [м] |
| 1                                                                                                                                                                           | 000101 0001 | 1     | 0.055600     | П2                     | 0.000780           | 386.10       | 270.5    |         |
| ~~~~~                                                                                                                                                                       |             |       |              |                        |                    |              |          |         |
| Суммарный Mq =                                                                                                                                                              |             |       | 0.055600 г/с |                        |                    |              |          |         |
| Сумма Cm по всем источникам =                                                                                                                                               |             |       |              |                        | 0.000780 долей ПДК |              |          |         |
| -----                                                                                                                                                                       |             |       |              |                        |                    |              |          |         |
| Средневзвешенная опасная скорость ветра = 386.10 м/с                                                                                                                        |             |       |              |                        |                    |              |          |         |
| -----                                                                                                                                                                       |             |       |              |                        |                    |              |          |         |
| Дальнейший расчет нецелесообразен: Сумма Cm < 0.05 долей ПДК                                                                                                                |             |       |              |                        |                    |              |          |         |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1      Расч.год: 2021 (СП)      Расчет проводился 23.08.2021 20:30  
 Сезон :ЛЕТО (температура воздуха 17.0 град.С)  
 Примесь :0337 - Углерода оксид  
 ПДКм.р для примеси 0337 = 5.0 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

|          |       |          |           |       |          |  |
|----------|-------|----------|-----------|-------|----------|--|
| Код загр | Штиль | Северное | Восточное | Южное | Западное |  |
|----------|-------|----------|-----------|-------|----------|--|



| вещества             | U<=2м/с   | направление | направление | направление | направление |
|----------------------|-----------|-------------|-------------|-------------|-------------|
| -----                |           |             |             |             |             |
| Пост N 001: X=0, Y=0 |           |             |             |             |             |
| 0337                 | 0.4000000 | 0.4000000   | 0.4000000   | 0.4000000   | 0.4000000   |
|                      | 0.0800000 | 0.0800000   | 0.0800000   | 0.0800000   | 0.0800000   |
| -----                |           |             |             |             |             |

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Средневзвешенная опасная скорость ветра U<sub>св</sub>= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0337 - Углерода оксид

ПДК<sub>м.р</sub> для примеси 0337 = 5.0 мг/м<sup>3</sup>

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 0

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Расшифровка\_обозначений

|                                             |  |
|---------------------------------------------|--|
| Qс - суммарная концентрация [доли ПДК]      |  |
| Сс - суммарная концентрация [мг/м.куб]      |  |
| Сф - фоновая концентрация [ доли ПДК ]      |  |
| Сф` - фон без реконструируемых [доли ПДК ]  |  |
| Сди- вклад действующих (для Сф`) [доли ПДК] |  |



```

 | Фоп- опасное направл. ветра [угл. град.] |
 | Уоп- опасная скорость ветра [м/с] |
|~~~~~|~~~~~|
| -Если в расчете один источник, то его вклад и код не печатаются|
| -Если в строке Смах=< 0.05 ПДК, то Фоп,Уоп,Ви,Ки не печатаются |
|~~~~~|~~~~~|

```

```

y= 2400 : Y-строка 1 Смах= 0.080 долей ПДК (x= -1923.0; напр.ветра=141)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 135 : 141 : 149 : 158 : 168 : 180 : 191 : 202 : 211 : 219 : 225 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

```

-----
y= 1920 : Y-строка 2 Смах= 0.080 долей ПДК (x= -1923.0; напр.ветра=135)
-----
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 129 : 135 : 143 : 153 : 166 : 180 : 194 : 207 : 217 : 225 : 231 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

```

y= 1440 : Y-строка 3 Смах= 0.080 долей ПДК (x= 1917.0; напр.ветра=233)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```





```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 121 : 127 : 135 : 146 : 162 : 180 : 198 : 213 : 225 : 233 : 239 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= 960 : Y-строка 4 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра=112)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 112 : 117 : 123 : 135 : 153 : 180 : 207 : 225 : 236 : 243 : 248 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= 480 : Y-строка 5 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра=101)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 101 : 104 : 108 : 117 : 135 : 180 : 225 : 243 : 252 : 256 : 259 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```



y= 0 : Y-строка 6 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 90)

|          |       |       |       |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| x= -2403 | -1923 | -1443 | -963  | -483  | -3    | 477   | 957   | 1437  | 1917  | 2397  |
| Qc       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cc       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 |
| Cф       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cф`      | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cди      | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Фоп      | 90    | 90    | 90    | 90    | 90    | 45    | 270   | 270   | 270   | 270   |
| Uоп      | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |

y= -480 : Y-строка 7 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 79)

|          |       |       |       |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| x= -2403 | -1923 | -1443 | -963  | -483  | -3    | 477   | 957   | 1437  | 1917  | 2397  |
| Qc       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cc       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 |
| Cф       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cф`      | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cди      | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Фоп      | 79    | 76    | 72    | 63    | 45    | 0     | 315   | 297   | 288   | 284   |
| Uоп      | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |

y= -960 : Y-строка 8 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 68)

|          |       |       |       |       |       |       |       |       |       |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| x= -2403 | -1923 | -1443 | -963  | -483  | -3    | 477   | 957   | 1437  | 1917  | 2397  |
| Qc       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cc       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 |
| Cф       | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cф`      | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 |
| Cди      | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Фоп      | 68    | 63    | 57    | 45    | 27    | 0     | 333   | 315   | 304   | 297   |



Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

у= -1440 : Y-строка 9 Смах= 0.080 долей ПДК (x= 1917.0; напр.ветра=307)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 59 : 53 : 45 : 34 : 18 : 0 : 342 : 327 : 315 : 307 : 301 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

у= -1920 : Y-строка 10 Смах= 0.080 долей ПДК (x= -1923.0; напр.ветра= 45)  
-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 51 : 45 : 37 : 27 : 14 : 0 : 346 : 333 : 323 : 315 : 309 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

у= -2400 : Y-строка 11 Смах= 0.080 долей ПДК (x= -1923.0; напр.ветра= 39)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:



Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 Фоп: 45 : 39 : 31 : 22 : 12 : 0 : 349 : 338 : 329 : 321 : 315 :
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
 ~~~~~

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Координаты точки : X= -1923.0 м, Y= 2400.0 м

Максимальная суммарная концентрация | Cs= 0.0800008 доли ПДКмр |  
 | 0.4000042 мг/м3 |  
 ~~~~~

Достигается при опасном направлении 141 град.
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада
 ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Козф. влияния
----	<Об-П>-<Ис>	----	---	М- (Мг) --	-С [доли ПДК]	-----	-----	---- b=C/M ----
				Фоновая концентрация Cf`	0.079999	100.0 (Вклад источников 0.0%)		
1	000101 0001	1	П2	0.0556	0.000001	99.8	99.8	0.000025278
				В сумме =	0.080001	99.8		

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые
 Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.
 Объект :0001 Строительная площадка.
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30
 Примесь :0337 - Углерода оксид
 ПДКм.р для примеси 0337 = 5.0 мг/м3



```

_____ Параметры расчетного прямоугольника No 1 _____
|  Координаты центра   : X=      -3 м;  Y=      0   |
|  Длина и ширина     : L=   4800 м;  B=   4800 м   |
|  Шаг сетки (dX=dY)  : D=    480 м   |
|  ~~~~~~

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Запрошен учет дифференцированного фона с постов для действующих источников
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{mp}) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

	1	2	3	4	5	6	7	8	9	10	11	
*--	----	----	----	----	----	-----C-----	----	----	----	----	----	----
1-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 1
2-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 2
3-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 3
4-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 4
5-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 5
6-C	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	C- 6
7-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 7
8-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 8
9-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	- 9
10-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	-10
11-	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	0.080	-11
	----	----	----	----	----	-----C-----	----	----	----	----	----	



1 2 3 4 5 6 7 8 9 10 11

В целом по расчетному прямоугольнику:

Максимальная концентрация -----> $C_m = 0.0800008$ долей ПДК_{мр}
 $= 0.4000042$ мг/м³

Достигается в точке с координатами: $X_m = -1923.0$ м
 (X-столбец 2, Y-строка 1) $Y_m = 2400.0$ м

При опасном направлении ветра : 141 град.
 и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :0337 - Углерода оксид
 ПДК_{м.р} для примеси 0337 = 5.0 мг/м³

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

Точка 1. Расчетная точка.

Координаты точки : $X = -618.0$ м, $Y = -524.0$ м

Максимальная суммарная концентрация | $C_s = 0.0800008$ доли ПДК_{мр} |
 | 0.4000041 мг/м³ |
 ~~~~~

Достигается при опасном направлении 50 град.  
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код | Режим | Тип | Выброс | Вклад | Вклад в% | Сум. % | Козф. влияния |
|------|-----|-------|-----|--------|-------|----------|--------|---------------|
|------|-----|-------|-----|--------|-------|----------|--------|---------------|



```

|----|<Об-П>~<Ис>|-----|---|---М- (Мq) --|-С [доли ПДК] |-----|-----|----- b=C/M ---|
|          Фоновая концентрация Cf` |    0.079999 | 100.0 (Вклад источников 0.0%) |
| 1 |000101 0001|    1 | П2|    0.0556|    0.000001 | 99.7 | 99.7 | 0.000024190 |
|          В сумме =    0.080001    99.7 |
~~~~~

```

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

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| Код                  | Реж       | Тип   | H1        | H2    | D     | Wo    | V1      | T     | X1      | Y1      | X2      | Y2      | Alf |
|----------------------|-----------|-------|-----------|-------|-------|-------|---------|-------|---------|---------|---------|---------|-----|
| F   КР   Ди   Выброс |           |       | RoГBC     |       |       |       |         |       |         |         |         |         |     |
| <Об~П>~<Ис>          | ~~~       | ~~~   | ~~М~~     | ~~М~~ | ~~М~~ | ~м/с~ | ~м3/с~  | градС | ~~~М~~~ | ~~~М~~~ | ~~~М~~~ | ~~~М~~~ | гр. |
| ~~~                  | ~~~       | ~~    | ~~~г/с~~~ | ~~~~~ |       |       |         |       |         |         |         |         |     |
| 000101 0001          | 1         | П2    | 2.0       |       | 90.0  | 3.00  | 19085.2 | 17.0  | 0       | 0       | 90      | 90      | 0   |
| 1.0 1.500 0          | 0.0128400 | 0.000 |           |       |       |       |         |       |         |         |         |         |     |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :2754 - Углеводороды предельные C12-C-19



ПДКм.р для примеси 2754 = 1.0 мг/м3

|                                                                                                                                                                                         |             |       |              |                        |                    |                |                |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------------|------------------------|--------------------|----------------|----------------|-------|
| - Для линейных и площадных источников выброс является суммарным по всей площади, а С <sub>м</sub> - концентрация одиночного источника, расположенного в центре симметрии, с суммарным М |             |       |              |                        |                    |                |                |       |
| ~~~~~                                                                                                                                                                                   |             |       |              |                        |                    |                |                |       |
| Источники                                                                                                                                                                               |             |       |              | Их расчетные параметры |                    |                |                |       |
| Номер                                                                                                                                                                                   | Код         | Режим | М            | Тип                    | С <sub>м</sub>     | U <sub>м</sub> | X <sub>м</sub> |       |
| -п/п-                                                                                                                                                                                   | <об-п>      | <ис>  | -----        | -----                  | -----              | - [доли ПДК]   | - [м/с]        | - [м] |
| 1                                                                                                                                                                                       | 000101 0001 | 1     | 0.012840     | П2                     | 0.000901           | 386.10         | 270.5          |       |
| ~~~~~                                                                                                                                                                                   |             |       |              |                        |                    |                |                |       |
| Суммарный M <sub>q</sub> =                                                                                                                                                              |             |       | 0.012840 г/с |                        |                    |                |                |       |
| Сумма С <sub>м</sub> по всем источникам =                                                                                                                                               |             |       |              |                        | 0.000901 долей ПДК |                |                |       |
| -----                                                                                                                                                                                   |             |       |              |                        |                    |                |                |       |
| Средневзвешенная опасная скорость ветра = 386.10 м/с                                                                                                                                    |             |       |              |                        |                    |                |                |       |
| -----                                                                                                                                                                                   |             |       |              |                        |                    |                |                |       |
| Дальнейший расчет нецелесообразен: Сумма С <sub>м</sub> < 0.05 долей ПДК                                                                                                                |             |       |              |                        |                    |                |                |       |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м3

Фоновая концентрация не задана

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с





Средневзвешенная опасная скорость ветра  $U_{св} = 386.1$  м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м<sup>3</sup>

Расчет не проводился:  $C_m < 0.05$  долей ПДК

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м<sup>3</sup>

Расчет не проводился:  $C_m < 0.05$  долей ПДК

10. Результаты расчета в фиксированных точках..

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м<sup>3</sup>



Расчет не проводился: См < 0.05 долей ПДК

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

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| Код                  | Реж    | Тип  | H1        | H2    | D     | Wo    | V1      | T     | X1     | Y1    | X2      | Y2      | Alf     |     |
|----------------------|--------|------|-----------|-------|-------|-------|---------|-------|--------|-------|---------|---------|---------|-----|
| F   КР   Ди   Выброс | <Об~П> | <Ис> | ~~~       | ~~~   | ~~м~~ | ~~м~~ | ~~м~~   | ~м/с~ | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | гр. |
| 000101               | 0001   | 1    | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 17.0  | 0      | 0     | 90      | 90      | 0       |     |
| 3.0                  | 1.500  | 1    | 0.0726600 | 0.000 |       |       |         |       |        |       |         |         |         |     |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м3



| - Для линейных и площадных источников выброс является суммарным по всей площади, а  $C_m$  - концентрация одиночного источника, расположенного в центре симметрии, с суммарным  $M$

| Источники                                                       |             |       |                    | Их расчетные параметры |                |             |               |
|-----------------------------------------------------------------|-------------|-------|--------------------|------------------------|----------------|-------------|---------------|
| Номер                                                           | Код         | Режим | M                  | Тип                    | $C_m$          | $U_m$       | $X_m$         |
| -п/п-                                                           | <об-п>-<ис> | ----  | -----              | ----                   | - [доли ПДК] - | -- [м/с] -- | ---- [м] ---- |
| 1                                                               | 000101 0001 | 1     | 0.072660           | П2                     | 0.030595       | 386.10      | 135.3         |
| Суммарный $M_q =$                                               |             |       | 0.072660 г/с       |                        |                |             |               |
| Сумма $C_m$ по всем источникам =                                |             |       | 0.030595 долей ПДК |                        |                |             |               |
| -----                                                           |             |       |                    |                        |                |             |               |
| Средневзвешенная опасная скорость ветра = 386.10 м/с            |             |       |                    |                        |                |             |               |
| -----                                                           |             |       |                    |                        |                |             |               |
| Дальнейший расчет нецелесообразен: Сумма $C_m < 0.05$ долей ПДК |             |       |                    |                        |                |             |               |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Примесь :2902 - Взвешенные вещества  
ПДКм.р для примеси 2902 = 0.5 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

| Код загр             | Штиль          | Северное    | Восточное   | Южное       | Западное    |
|----------------------|----------------|-------------|-------------|-------------|-------------|
| вещества             | $U \leq 2$ м/с | направление | направление | направление | направление |
| -----                |                |             |             |             |             |
| Пост N 001: X=0, Y=0 |                |             |             |             |             |
| 2902                 | 0.2000000      | 0.2000000   | 0.2000000   | 0.2000000   | 0.2000000   |
|                      | 0.4000000      | 0.4000000   | 0.4000000   | 0.4000000   | 0.4000000   |
| -----                |                |             |             |             |             |



Расчет по прямоугольнику 001 : 4800x4800 с шагом 480  
Расчет в фиксированных точках. Группа точек 090  
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с  
Средневзвешенная опасная скорость ветра U<sub>св</sub>= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м<sup>3</sup>

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 0

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

Расшифровка\_обозначений

|                                             |  |
|---------------------------------------------|--|
| Qс - суммарная концентрация [доли ПДК]      |  |
| Сс - суммарная концентрация [мг/м.куб]      |  |
| Сф - фоновая концентрация [ доли ПДК ]      |  |
| Сф` - фон без реконструируемых [доли ПДК ]  |  |
| Сди- вклад действующих (для Сф`) [доли ПДК] |  |
| Фоп- опасное направл. ветра [ угл. град.]   |  |
| Уоп- опасная скорость ветра [ м/с ]         |  |

```

| ~~~~~~ |
| -Если в расчете один источник, то его вклад и код не печатаются|
| -Если в строке Смах=< 0.05 ПДК, то Фоп, Уоп, Ви, Ки не печатаются |
| ~~~~~~ |

```





y= 2400 : Y-строка 1 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра=135)

---

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

---

Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:

Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

Фоп: 135 : 141 : 149 : 158 : 169 : 180 : 191 : 202 : 211 : 219 : 225 :

Uоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :

~~~~~

y= 1920 : Y-строка 2 Cmax= 0.400 долей ПДК (x= -1923.0; напр.ветра=135)

---

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

---

Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:

Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

Фоп: 129 : 135 : 143 : 153 : 166 : 180 : 194 : 207 : 217 : 225 : 231 :

Uоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :

~~~~~

y= 1440 : Y-строка 3 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра=121)

---

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

---

Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:

Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:

Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:



Фоп: 121 : 127 : 135 : 146 : 161 : 180 : 198 : 214 : 225 : 233 : 239 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= 960 : Y-строка 4 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра=112)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 112 : 117 : 124 : 135 : 153 : 180 : 206 : 225 : 236 : 243 : 248 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= 480 : Y-строка 5 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра=101)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 101 : 104 : 108 : 117 : 135 : 180 : 225 : 243 : 252 : 256 : 259 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= 0 : Y-строка 6 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:



Сф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 90 : 90 : 90 : 90 : 90 : 48 : 270 : 270 : 270 : 270 : 270 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

y= -480 : Y-строка 7 Стах= 0.400 долей ПДК (x= -2403.0; напр.ветра= 79)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:  
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
Сф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 79 : 76 : 72 : 63 : 45 : 0 : 315 : 297 : 288 : 284 : 281 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

y= -960 : Y-строка 8 Стах= 0.400 долей ПДК (x= -2403.0; напр.ветра= 68)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:  
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
Сф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 68 : 63 : 56 : 45 : 27 : 0 : 334 : 315 : 304 : 297 : 292 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

y= -1440 : Y-строка 9 Стах= 0.400 долей ПДК (x= -2403.0; напр.ветра= 59)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:



```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 59 : 53 : 45 : 34 : 19 : 0 : 342 : 326 : 315 : 307 : 301 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= -1920 : Y-строка 10 Cmax= 0.400 долей ПДК (x= -1923.0; напр.ветра= 45)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 51 : 45 : 37 : 27 : 14 : 0 : 346 : 333 : 323 : 315 : 309 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= -2400 : Y-строка 11 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра= 45)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 45 : 39 : 31 : 22 : 11 : 0 : 349 : 338 : 329 : 321 : 315 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```





Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
Расчет проводится в соответствии с документом МРР-2017  
Координаты точки : X= -2403.0 м, Y= 2400.0 м

Максимальная суммарная концентрация | Cs= 0.4000331 доли ПДКмр |  
| 0.2000166 мг/м3 |  
~~~~~

Достигается при опасном направлении 135 град.
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Кэф. влияния
----	<Об-П>	<Ис>	----	М- (Мг)	-С [доли ПДК]	-----	-----	b=C/M
				Фоновая концентрация Cf`	0.399978	100.0	(Вклад источников 0.0%)	
1	000101	0001	1	П2	0.000055	100.0	100.0	0.000759707
				В сумме =	0.400033	100.0		

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые
Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30
Примесь :2902 - Взвешенные вещества
ПДКм.р для примеси 2902 = 0.5 мг/м3

Параметры расчетного прямоугольника No 1
| Координаты центра : X= -3 м; Y= 0 |
| Длина и ширина : L= 4800 м; В= 4800 м |
| Шаг сетки (dX=dY) : D= 480 м |
~~~~~

Запрошен учет дифференцированного фона с постов для действующих источников



Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

|                                                                       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |
|-----------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| *-- ----- ----- ----- ----- -----C----- ----- ----- ----- ----- ----- |       |       |       |       |       |       |       |       |       |       |       |      |
| 1-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 1  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 2-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 2  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 3-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 3  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 4-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 4  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 5-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 5  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 6-C                                                                   | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | C- 6 |
|                                                                       |       |       |       |       |       | ^     |       |       |       |       |       |      |
| 7-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 7  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 8-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 8  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 9-                                                                    | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 9  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 10-                                                                   | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | -10  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 11-                                                                   | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | -11  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| -- ----- ----- ----- ----- -----C----- ----- ----- ----- ----- -----  |       |       |       |       |       |       |       |       |       |       |       |      |
|                                                                       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |

В целом по расчетному прямоугольнику:

Максимальная концентрация -----> См = 0.4000331 долей ПДК<sub>мр</sub>  
= 0.2000166 мг/м<sup>3</sup>

Достигается в точке с координатами: Хм = -2403.0 м



( X-столбец 1, Y-строка 1)                      Ум = 2400.0 м  
При опасном направлении ветра        :        135 град.  
и "опасной" скорости ветра            :        25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1            Расч.год: 2021 (СП)                      Расчет проводился 23.08.2021 20:30

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м3

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0(Умр) м/с

Точка 1. Расчетная точка.

Координаты точки : X= -618.0 м, Y= -524.0 м

Максимальная суммарная концентрация | Cs= 0.4000316 доли ПДКмр |  
| | 0.2000158 мг/м3 |

Достигается при опасном направлении 50 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код    | Режим | Тип   | Выброс                   | Вклад      | Вклад в%     | Сум. %                  | Козф.влияния        |
|------|--------|-------|-------|--------------------------|------------|--------------|-------------------------|---------------------|
| ---- | <Об-П> | <Ис>  | ----- | --- ---                  | М- (Мг) -- | -С[доли ПДК] | -----                   | ----- b=C/M ---     |
|      |        |       |       | Фоновая концентрация Cf` | 0.399979   | 100.0        | (Вклад источников 0.0%) |                     |
| 1    | 000101 | 0001  | 1     | П2                       | 0.0727     | 0.000053     | 100.0                   | 100.0   0.000725715 |
|      |        |       |       | В сумме =                | 0.400032   | 100.0        |                         |                     |



3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Коэфф. комбинированного действия = 1.60

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

| Код                     | Реж   | Тип | H1        | H2    | D    | Wo   | V1      | T      | X1    | Y1  | X2  | Y2  | Alf |
|-------------------------|-------|-----|-----------|-------|------|------|---------|--------|-------|-----|-----|-----|-----|
| F                       | КР    | Ди  | Выброс    | RoГВС |      |      |         |        |       |     |     |     |     |
| <Об~П>                  | <Ис>  | ~   | ~         | ~м~   | ~м~  | ~м~  | ~м/с~   | ~м3/с~ | градС | ~м~ | ~м~ | ~м~ | ~м~ |
| ~                       | ~     | ~   | ~г/с~     | ~     | ~    | ~    | ~       | ~      | ~     | ~   | ~   | ~   | гр. |
| ----- Примесь 0301----- |       |     |           |       |      |      |         |        |       |     |     |     |     |
| 000101                  | 0001  | 1   | П2        | 2.0   | 90.0 | 3.00 | 19085.2 | 17.0   | 0     | 0   | 90  | 90  | 0   |
| 1.0                     | 1.500 | 1   | 0.0648000 | 0.000 |      |      |         |        |       |     |     |     |     |
| ----- Примесь 0330----- |       |     |           |       |      |      |         |        |       |     |     |     |     |
| 000101                  | 0001  | 1   | П2        | 2.0   | 90.0 | 3.00 | 19085.2 | 17.0   | 0     | 0   | 90  | 90  | 0   |
| 1.0                     | 1.500 | 1   | 0.0062000 | 0.000 |      |      |         |        |       |     |     |     |     |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид





Кoeff. комбинированного действия = 1.60

|                                                                                                                                                                                 |             |       |                    |                                   |              |            |       |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------------------|-----------------------------------|--------------|------------|-------|--|
| - Для групп суммации выброс $Mq = M1/ПДК1 + \dots + Mn/ПДКn$ , а суммарная концентрация $Cm = Cm1/ПДК1 + \dots + Cmн/ПДКн$                                                      |             |       |                    |                                   |              |            |       |  |
| - Для линейных и площадных источников выброс является суммарным по всей площади, а $Cm$ - концентрация одиночного источника, расположенного в центре симметрии, с суммарным $M$ |             |       |                    |                                   |              |            |       |  |
| ~~~~~                                                                                                                                                                           |             |       |                    |                                   |              |            |       |  |
| Источники                                                                                                                                                                       |             |       |                    | Их расчетные параметры            |              |            |       |  |
| Номер                                                                                                                                                                           | Код         | Режим | $Mq$               | Тип                               | $Cm$         | $Um$       | $Xm$  |  |
| -п/п-                                                                                                                                                                           | <об-п>      | <ис>  | -----              | -----                             | - [доли ПДК] | - [м/с]    | - [м] |  |
| 1                                                                                                                                                                               | 000101 0001 | 1     | 0.210250           | П2                                | 0.014755     | 386.10     | 270.5 |  |
| ~~~~~                                                                                                                                                                           |             |       |                    |                                   |              |            |       |  |
| Суммарный $Mq =$                                                                                                                                                                |             |       | 0.210250           | (сумма $Mq/ПДК$ по всем примесям) |              |            |       |  |
| Сумма $Cm$ по всем источникам =                                                                                                                                                 |             |       | 0.014755 долей ПДК |                                   |              |            |       |  |
| -----                                                                                                                                                                           |             |       |                    |                                   |              |            |       |  |
| Средневзвешенная опасная скорость ветра =                                                                                                                                       |             |       |                    |                                   |              | 386.10 м/с |       |  |
| -----                                                                                                                                                                           |             |       |                    |                                   |              |            |       |  |
| Дальнейший расчет нецелесообразен: Сумма $Cm < 0.05$ долей ПДК                                                                                                                  |             |       |                    |                                   |              |            |       |  |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Сезон :ЛЕТО (температура воздуха 17.0 град.С)

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Кoeff. комбинированного действия = 1.60

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

|          |       |          |           |       |          |  |
|----------|-------|----------|-----------|-------|----------|--|
| Код загр | Штиль | Северное | Восточное | Южное | Западное |  |
|----------|-------|----------|-----------|-------|----------|--|



| вещества             | U<=2м/с   | направление | направление | направление | направление |
|----------------------|-----------|-------------|-------------|-------------|-------------|
| -----                |           |             |             |             |             |
| Пост N 001: X=0, Y=0 |           |             |             |             |             |
| 0301                 | 0.0080000 | 0.0080000   | 0.0080000   | 0.0080000   | 0.0080000   |
|                      | 0.0400000 | 0.0400000   | 0.0400000   | 0.0400000   | 0.0400000   |
| 0330                 | 0.0200000 | 0.0200000   | 0.0200000   | 0.0200000   | 0.0200000   |
|                      | 0.0400000 | 0.0400000   | 0.0400000   | 0.0400000   | 0.0400000   |
| -----                |           |             |             |             |             |

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

Средневзвешенная опасная скорость ветра U<sub>св</sub>= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Коэфф. комбинированного действия = 1.60

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 0

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

Расшифровка\_обозначений

|                                        |  |
|----------------------------------------|--|
| Qс - суммарная концентрация [доли ПДК] |  |
| Сф - фоновая концентрация [ доли ПДК ] |  |



| Сф`- фон без реконструируемых [доли ПДК ] |  
 | Сди- вклад действующих (для Сф`) [доли ПДК] |  
 | Фоп- опасное направл. ветра [ угл. град.] |  
 | Уоп- опасная скорость ветра [ м/с ] |  
 | 301- % вклада NO2 в суммарную концентрацию |

~~~~~|  
 | -При расчете по группе суммации концентр. в мг/м3 не печатается|
 | -Если в расчете один источник, то его вклад и код не печатаются|
 | -Если в строке Смах=< 0.05 ПДК, то Фоп, Уоп, Ви, Ки не печатаются |
 ~~~~~|

-----  
 у= 2400 : Y-строка 1 Смах= 0.050 долей ПДК (x= -2403.0; напр.ветра=135)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

 у= 1920 : Y-строка 2 Смах= 0.050 долей ПДК (x= -1923.0; напр.ветра=135)

 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

-----  
 у= 1440 : Y-строка 3 Смах= 0.050 долей ПДК (x= -2403.0; напр.ветра=121)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 ~~~~~



Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

-----  
y= 960 : Y-строка 4 Стах= 0.050 долей ПДК (x= 2397.0; напр.ветра=248)  
-----  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
~~~~~

y= 480 : Y-строка 5 Стах= 0.050 долей ПДК (x= -2403.0; напр.ветра=101)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

-----  
y= 0 : Y-строка 6 Стах= 0.050 долей ПДК (x= -2403.0; напр.ветра= 90)  
-----  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
~~~~~

y= -480 : Y-строка 7 Стах= 0.050 долей ПДК (x= -2403.0; напр.ветра= 79)



```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -960 : Y-строка 8 Cmax= 0.050 долей ПДК (x= 2397.0; напр.ветра=292)

```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -1440 : Y-строка 9 Cmax= 0.050 долей ПДК (x= -2403.0; напр.ветра= 59)

```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -1920 : Y-строка 10 Cmax= 0.050 долей ПДК (x= -1923.0; напр.ветра= 45)

```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:

```




ПК ЭРА v3.0. Модель: Разовые
 Расчет проводится в соответствии с документом MPP-2017
 Город :041 Каджаран.
 Объект :0001 Строительная площадка.
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30
 Группа суммации :6204=0301 Азота диоксид
 0330 Серы диоксид
 Коэфф. комбинированного действия = 1.60

 Параметры_расчетного_прямоугольника_Но 1_____
 | Координаты центра : X= -3 м; Y= 0 |
 | Длина и ширина : L= 4800 м; В= 4800 м |
 | Шаг сетки (dX=dY) : D= 480 м |
 ~~~~~

Запрошен учет дифференцированного фона с постов для действующих источников  
 Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
 Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Ump) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

|     | 1     | 2     | 3     | 4     | 5     | 6           | 7     | 8     | 9     | 10    | 11    |       |
|-----|-------|-------|-------|-------|-------|-------------|-------|-------|-------|-------|-------|-------|
| *-- | ----- | ----- | ----- | ----- | ----- | -----C----- | ----- | ----- | ----- | ----- | ----- | ----- |
| 1-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 1   |
| 2-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 2   |
| 3-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 3   |
| 4-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 4   |
| 5-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 5   |
| 6-C | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | C- 6  |
| 7-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050       | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | - 7   |



|     |       |       |       |       |       |       |       |       |       |       |       |       |    |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|
| 8-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 8  |
| 9-  | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 9  |
| 10- | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 10 |
| 11- | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 11 |
|     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |       |    |

В целом по расчетному прямоугольнику:

Безразмерная макс. концентрация --->  $C_m = 0.0500160$

Достигается в точке с координатами:  $X_m = -2403.0$  м

( X-столбец 1, Y-строка 1)  $Y_m = 2400.0$  м

При опасном направлении ветра : 135 град.

и "опасной" скорости ветра : 25.00 м/с

#### 10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :041 Каджаран.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:30

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Кэфф. комбинированного действия = 1.60

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 ( $U_{mp}$ ) м/с

Точка 1. Расчетная точка.





Координаты точки : X= -618.0 м, Y= -524.0 м

Максимальная суммарная концентрация | Cs= 0.0500153 доли ПДК<sub>мр</sub> |

Достигается при опасном направлении 50 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код                      | Режим | Тип  | Выброс     | Вклад         | Вклад в%                     | Сум. % | Кэф. влияния |
|------|--------------------------|-------|------|------------|---------------|------------------------------|--------|--------------|
| ---- | <Об-П>                   | <Ис>  | ---- | М- (Мг) -- | -С [доли ПДК] | -----                        | -----  | b=C/M        |
|      | Фоновая концентрация Cf` |       |      | 0.049990   | 0.049990      | 99.9 (Вклад источников 0.1%) |        |              |
| 1    | 000101                   | 0001  | 1    | П2         | 0.2103        | 0.000025                     | 100.0  | 100.0        |
|      |                          |       |      | В сумме =  | 0.050015      | 100.0                        |        |              |





Горид : 041 Кичево  
Објект : 0001 Строителна площадка Вар.Нр 1  
ПК ЗРА v3.0, Модел : МРП-2017  
0330 Средна вода



Условни означенија:  
| Подготвена подградба  
x Пловачка школа (градина 00)  
| Мокрина (канал за наводнување)  
| Ресурс центар (МЗ)

Изобичајни додеки ПДК:  
— 2140 ПДК  
— 2145 ПДК  
— 2150 ПДК  
— 2160 ПДК



Решенија на предметот се на 1. Општина  
Мокрина (градина 000000) (ПК доставителски проект - 0203) и 2803  
При изготвување на проектот се користени податоци од 2017 г.  
Изобичајни податоци се на 1. Општина 0203 и 2803  
за да се види состојбата на предметот (ПК доставителски проект - 0203)  
Решенија на предметот се на 1. Општина







Город : 041 Каджарци  
Објект : 0001 Стратегијска пројекција Вар.№1  
ПК ДРА v3.0, Издание: МРР-2017  
2002 Влезниот водосток



Условне ознаки:

- Градска зона (ГЗ)
- Ресурсна зона (РЗ)
- Зона за заштита на животна средина (ЗЖС)
- Зона за заштита на водни ресурси (ЗВР)

Изобилност во општини (ИО):

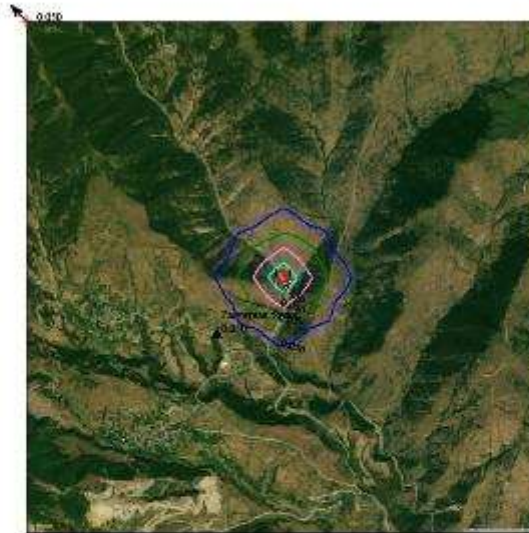
- 0-100 (ЛЗ)
- 100-200 (ЛЗ)
- 200-300 (ЛЗ)
- 300-400 (ЛЗ)



Подготвено со помош на: Т-ОКСИОН  
Условен изобилност во општини (ИО) добиена од проектот е од 0-100 до 400.  
Функционална зона (ФЗ) е од 100 до 200 м од проектот.  
Зона за заштита на животна средина (ЗЖС) е од 100 до 200 м од проектот.  
Зона за заштита на водни ресурси (ЗВР) е од 100 до 200 м од проектот.  
Резултатите се дадени во табелата подолу.



Город : 041 Каджерак  
Объект : 0001 Строительная площадка Вар.ЭР 1  
ПК : ЭРА v3.0. Мульти : МРР-2017  
6204.0301+0330



Основные обозначения:  
- Прогнозируемая территория  
+ Рабочий объект (площадка ЭР)  
o Маршрут и точки его выхода за пределы  
Площ. градостроительной зоны

Изолинии уровня шума:  
- с 65 дБ(А)  
- с 60 дБ(А)  
- с 55 дБ(А)  
- с 50 дБ(А)



Уровень радиационной безопасности 1 - Уровневый  
Метод: методика СНЗ (СНЗ) ППР, разработанная компанией ООО «ЭРА»  
Плотность радиационной нагрузки: 0,01 мкЗв/ч (0,0001 мкСv/ч)  
Радиационная характеристика: 100 мкЗв/ч (0,001 мСv/ч)  
Источники радиации: 100 мкЗв/ч (0,001 мСv/ч)  
Источники радиации: 100 мкЗв/ч (0,001 мСv/ч)  
Плотность радиационной нагрузки: 0,01 мкЗв/ч (0,0001 мСv/ч)

### 1. Общие сведения.

Расчет проведен на ПК "ЭРА" v3.0 фирмы НПП "Логос-Плюс", Новосибирск



в соответствии с положениями документа "Методы расчетов рассеивания выбросов вредных (загрязняющих) веществ в атмосферном воздухе" (МРР-2017).  
Расчет выполнен ООО "Консекоард" (Consecoard LLC)

---

| Заключение экспертизы Министерства природных ресурсов и Росгидромета |  
| на программу: письмо № 140-09213/20и от 30.11.2020 |

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## 2. Параметры города

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Название: Мегри

Коэффициент А = 200

Скорость ветра  $U_{mr}$  = 25.0 м/с (для лета 25.0, для зимы 12.0)

Средняя скорость ветра = 5.0 м/с

Температура летняя = 26.3 град.С

Температура зимняя = -1.5 град.С

Коэффициент рельефа = 1.25

Площадь города = 0.0 кв.км

Угол между направлением на СЕВЕР и осью X = 90.0 угловых градусов

## 3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников



| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|
| F      | КР    | Ди  | Выброс    | RoГBC |       |       |         |        |       |         |         |         |         |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 20.0   | 5     | 5       | 90      | 90      | 0       |
| 1.0    | 1.250 | 1   | 0.0648000 | 0.000 |       |       |         |        |       |         |         |         |         |

4. Расчетные параметры См, Um, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

|                                                                                                                                                                             |        |       |                               |                        |                    |           |             |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|-------------------------------|------------------------|--------------------|-----------|-------------|-------|
| - Для линейных и площадных источников выброс является суммарным по всей площади, а См - концентрация одиночного источника, расположенного в центре симметрии, с суммарным М |        |       |                               |                        |                    |           |             |       |
| ~~~~~                                                                                                                                                                       |        |       |                               |                        |                    |           |             |       |
| Источники                                                                                                                                                                   |        |       |                               | Их расчетные параметры |                    |           |             |       |
| Номер                                                                                                                                                                       | Код    | Режим | М                             | Тип                    | См                 | Um        | Xm          |       |
| -п/п-                                                                                                                                                                       | <об-п> | <ис>  | -----                         | -----                  | -[доли ПДК]-       | --[м/с]-- | ----[м]---- |       |
| 1                                                                                                                                                                           | 000101 | 0001  | 1                             | 0.064800               | П2                 | 0.018948  | 386.10      | 294.6 |
| ~~~~~                                                                                                                                                                       |        |       |                               |                        |                    |           |             |       |
|                                                                                                                                                                             |        |       | Суммарный Мq =                |                        | 0.064800 г/с       |           |             |       |
|                                                                                                                                                                             |        |       | Сумма См по всем источникам = |                        | 0.018948 долей ПДК |           |             |       |
| -----                                                                                                                                                                       |        |       |                               |                        |                    |           |             |       |
| Средневзвешенная опасная скорость ветра = 386.10 м/с                                                                                                                        |        |       |                               |                        |                    |           |             |       |
| -----                                                                                                                                                                       |        |       |                               |                        |                    |           |             |       |
| Дальнейший расчет нецелесообразен: Сумма См < 0.05 долей ПДК                                                                                                                |        |       |                               |                        |                    |           |             |       |





5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

| Код загр<br>вещества | Штиль<br>U<=2м/с | Северное<br>направление | Восточное<br>направление | Южное<br>направление | Западное<br>направление |
|----------------------|------------------|-------------------------|--------------------------|----------------------|-------------------------|
| -----                |                  |                         |                          |                      |                         |
| Пост N 001: X=0, Y=0 |                  |                         |                          |                      |                         |
| 0301                 | 0.0080000        | 0.0080000               | 0.0080000                | 0.0080000            | 0.0080000               |
|                      | 0.0400000        | 0.0400000               | 0.0400000                | 0.0400000            | 0.0400000               |
| -----                |                  |                         |                          |                      |                         |

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

Средневзвешенная опасная скорость ветра U<sub>св</sub>= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3



Расчет проводился на прямоугольнике 1  
с параметрами: координаты центра X= -3, Y= 3  
размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480  
Запрошен учет дифференцированного фона с постов для действующих источников  
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

```

                Расшифровка_обозначений
    | Qc - суммарная концентрация [доли ПДК]          |
    | Cc - суммарная концентрация [мг/м.куб]          |
    | Cf - фоновая концентрация [ доли ПДК ]          |
    | Cf`- фон без реконструируемых [доли ПДК ]      |
    | Cди- вклад действующих (для Cf`) [доли ПДК]    |
    | Фоп- опасное направл. ветра [ угл. град.]       |
    | Уоп- опасная скорость ветра [ м/с ]           |
| ~~~~~~|
| -Если в расчете один источник, то его вклад и код не печатаются|
| -Если в строке Смах=< 0.05 ПДК, то Фоп,Уоп,Ви,Ки не печатаются |
| ~~~~~~|

```

```

-----
y= 2403 : Y-строка 1 Смах= 0.040 долей ПДК (x= -2403.0; напр.ветра=135)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:
Cf : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cf` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

```

y= 1923 : Y-строка 2 Смах= 0.040 долей ПДК (x= 1917.0; напр.ветра=225)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

```



Сс : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

\_\_\_\_\_  
 у= 1443 : Y-строка 3 Смах= 0.040 долей ПДК (x= 2397.0; напр.ветра=239)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сс : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

\_\_\_\_\_  
 у= 963 : Y-строка 4 Смах= 0.040 долей ПДК (x= 2397.0; напр.ветра=248)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сс : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

\_\_\_\_\_  
 у= 483 : Y-строка 5 Смах= 0.040 долей ПДК (x= -2403.0; напр.ветра=101)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сс : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:



Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= 3 : Y-строка 6 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 90)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= -477 : Y-строка 7 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 79)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= -957 : Y-строка 8 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=292)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~





y= -1437 : Y-строка 9 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 59)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -1917 : Y-строка 10 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=309)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -2397 : Y-строка 11 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 45)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008: 0.008:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017



Координаты точки : X= -2403.0 м, Y= 2403.0 м

|                                     |     |                      |
|-------------------------------------|-----|----------------------|
| Максимальная суммарная концентрация | Cs= | 0.0400205 доли ПДКмр |
|                                     |     | 0.0080041 мг/м3      |

Достигается при опасном направлении 135 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код                      | Режим | Тип  | Выброс    | Вклад         | Вклад в%                     | Сум. % | Кэф. влияния |
|------|--------------------------|-------|------|-----------|---------------|------------------------------|--------|--------------|
| ---- | <Об-П>                   | <Ис>  | ---- | М- (Мг)   | -С [доли ПДК] | -----                        | -----  | b=C/M        |
|      | Фоновая концентрация Cf` |       |      |           | 0.039986      | 99.9 (Вклад источников 0.1%) |        |              |
| 1    | 000101                   | 0001  | 1    | П2        | 0.0648        | 0.000034                     | 100.0  | 100.0        |
|      |                          |       |      | В сумме = | 0.040021      | 100.0                        |        |              |

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Параметры расчетного прямоугольника No 1

|                   |      |         |    |        |
|-------------------|------|---------|----|--------|
| Координаты центра | : X= | -3 м;   | Y= | 3      |
| Длина и ширина    | : L= | 4800 м; | V= | 4800 м |
| Шаг сетки (dX=dY) | : D= | 480 м   |    |        |

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Uмр) м/с



(Символ ^ означает наличие источника вблизи расчетного узла)

|                                                                       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |
|-----------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| *-- ----- ----- ----- ----- -----C----- ----- ----- ----- ----- ----- |       |       |       |       |       |       |       |       |       |       |       |      |
| 1-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 1  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 2-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 2  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 3-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 3  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 4-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 4  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 5-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 5  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 6-C                                                                   | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | C- 6 |
|                                                                       |       |       |       |       |       | ^     |       |       |       |       |       |      |
| 7-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 7  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 8-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 8  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 9-                                                                    | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | - 9  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 10-                                                                   | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | -10  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| 11-                                                                   | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | 0.040 | -11  |
|                                                                       |       |       |       |       |       |       |       |       |       |       |       |      |
| -- ----- ----- ----- ----- -----C----- ----- ----- ----- -----        |       |       |       |       |       |       |       |       |       |       |       |      |
|                                                                       | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |

В целом по расчетному прямоугольнику:

Максимальная концентрация -----> См = 0.0400205 долей ПДК<sub>мр</sub>  
= 0.0080041 мг/м<sup>3</sup>

Достигается в точке с координатами: Х<sub>м</sub> = -2403.0 м  
( X-столбец 1, Y-строка 1) У<sub>м</sub> = 2403.0 м

При опасном направлении ветра : 135 град.  
и "опасной" скорости ветра : 25.00 м/с



10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0301 - Азота диоксид

ПДКм.р для примеси 0301 = 0.2 мг/м3

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Точка 1. Расчетная точка.

Координаты точки : X= 253.0 м, Y= -1202.0 м

|                                     |                                      |
|-------------------------------------|--------------------------------------|
| Максимальная суммарная концентрация | Cs= 0.0400201 доли ПДК <sub>мр</sub> |
|                                     | 0.0080040 мг/м3                      |

Достигается при опасном направлении 348 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код                      | Режим | Тип | Выброс               | Вклад         | Вклад в%                | Сум. % | Коэф. влияния |
|------|--------------------------|-------|-----|----------------------|---------------|-------------------------|--------|---------------|
|      | <Об-П>                   | <Ис>  |     | М- (М <sub>г</sub> ) | -С [доли ПДК] |                         |        | b=C/M         |
|      | Фоновая концентрация Cf` |       |     | 0.039987             | 99.9          | (Вклад источников 0.1%) |        |               |
| 1    | 000101                   | 0001  | 1   | П2                   | 0.0648        | 100.0                   | 100.0  | 0.000517295   |
|      | В сумме =                |       |     | 0.040020             | 100.0         |                         |        |               |

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые





Расчет проводится в соответствии с документом МРР-2017  
 Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45  
 Примесь :0328 - Углерод  
 ПДКм.р для примеси 0328 = 0.15 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников  
 Коэффициент оседания (F): индивидуальный с источников

| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|
| F      | КР    | Ди  | Выброс    | RoГВС |       |       |         | градС  |       |         |         |         | гр.     |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ |
| ~~~    | ~~~   | ~~  | ~~~г/с~~~ | ~~~~~ |       |       |         |        |       |         |         |         |         |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 20.0   | 5     | 5       | 90      | 90      | 0       |
| 3.0    | 1.250 | 0   | 0.0066000 | 0.000 |       |       |         |        |       |         |         |         |         |

4. Расчетные параметры См, Um, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45  
 Сезон :ЛЕТО (температура воздуха 26.3 град.С)  
 Примесь :0328 - Углерод  
 ПДКм.р для примеси 0328 = 0.15 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей площади, а См - концентрация одиночного источника, расположенного в центре симметрии, с суммарным М

| Источники |     |       |   | Их расчетные параметры |    |    |    |
|-----------|-----|-------|---|------------------------|----|----|----|
| Номер     | Код | Режим | M | Тип                    | См | Um | Xm |



| -п/п-                                         | <об-п>-<ис> | -----              | -----    | ----- | - [доли ПДК] - | --- [м/с] --- | ----- [м] ---- |
|-----------------------------------------------|-------------|--------------------|----------|-------|----------------|---------------|----------------|
| 1                                             | 000101 0001 | 1                  | 0.006600 | П2    | 0.007720       | 386.10        | 147.3          |
| ~~~~~                                         |             |                    |          |       |                |               |                |
| Суммарный Мq =                                |             | 0.006600 г/с       |          |       |                |               |                |
| Сумма См по всем источникам =                 |             | 0.007720 долей ПДК |          |       |                |               |                |
| -----                                         |             |                    |          |       |                |               |                |
| Средневзвешенная опасная скорость ветра =     |             | 386.10 м/с         |          |       |                |               |                |
| -----                                         |             |                    |          |       |                |               |                |
| Дальнейший расчет нецелесообразен: Сумма См < |             | 0.05 долей ПДК     |          |       |                |               |                |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м3

Фоновая концентрация не задана

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Ump) м/с

Средневзвешенная опасная скорость ветра Uсв= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0328 - Углерод



ПДКм.р для примеси 0328 = 0.15 мг/м<sup>3</sup>

Расчет не проводился: См < 0.05 долей ПДК

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м<sup>3</sup>

Расчет не проводился: См < 0.05 долей ПДК

10. Результаты расчета в фиксированных точках..

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Примесь :0328 - Углерод

ПДКм.р для примеси 0328 = 0.15 мг/м<sup>3</sup>

Расчет не проводился: См < 0.05 долей ПДК

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.



Вар.расч. :1      Расч.год: 2021 (СП)      Расчет проводился 23.08.2021 20:45  
Примесь :0330 - Серы диоксид  
ПДКм.р для примеси 0330 = 0.5 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников  
Коэффициент оседания (F): индивидуальный с источников

| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|-----|
| F      | КР    | Ди  | Выброс    | RoГВС |       |       |         |        |       |         |         |         |         |     |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | гр. |
| ~~~    | ~~~   | ~~  | ~~~Г/с~~~ | ~~~~~ |       |       |         |        |       |         |         |         |         |     |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 20.0   | 5     | 5       | 90      | 90      | 0       |     |
| 1.0    | 1.250 | 1   | 0.0062000 | 0.000 |       |       |         |        |       |         |         |         |         |     |

4. Расчетные параметры См,Um,Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Метри.

Объект :0001 Строительная площадка.

Вар.расч. :1      Расч.год: 2021 (СП)      Расчет проводился 23.08.2021 20:45

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0330 - Серы диоксид

ПДКм.р для примеси 0330 = 0.5 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей площади, а См - концентрация одиночного источника, расположенного в центре симметрии, с суммарным М

| Источники |        |       |       | Их расчетные параметры |               |            |              |       |
|-----------|--------|-------|-------|------------------------|---------------|------------|--------------|-------|
| Номер     | Код    | Режим | М     | Тип                    | См            | Um         | Хм           |       |
| -п/п-     | <об-п> | <ис>  | ----- | -----                  | - [доли ПДК]- | -- [м/с]-- | ---- [м]---- |       |
| 1         | 000101 | 0001  | 1     | 0.006200               | П2            | 0.000725   | 386.10       | 294.6 |





|                                                                 |
|-----------------------------------------------------------------|
| Суммарный $Mq = 0.006200$ г/с                                   |
| Сумма $C_m$ по всем источникам = $0.000725$ долей ПДК           |
| -----                                                           |
| Средневзвешенная опасная скорость ветра = $386.10$ м/с          |
| -----                                                           |
| Дальнейший расчет нецелесообразен: Сумма $C_m < 0.05$ долей ПДК |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0330 - Серы диоксид

ПДКм.р для примеси 0330 =  $0.5$  мг/м<sup>3</sup>

Фоновая концентрация на постах (в мг/м<sup>3</sup> / долях ПДК)

| Код загр. вещества   | Штиль $U \leq 2$ м/с | Северное направление | Восточное направление | Южное направление | Западное направление |
|----------------------|----------------------|----------------------|-----------------------|-------------------|----------------------|
| -----                |                      |                      |                       |                   |                      |
| Пост N 001: X=0, Y=0 |                      |                      |                       |                   |                      |
| 0330                 | 0.0200000            | 0.0200000            | 0.0200000             | 0.0200000         | 0.0200000            |
|                      | 0.0400000            | 0.0400000            | 0.0400000             | 0.0400000         | 0.0400000            |

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Средневзвешенная опасная скорость ветра  $U_{св} = 386.1$  м/с

6. Результаты расчета в виде таблицы.



ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45  
 Примесь :0330 - Серы диоксид  
 ПДКм.р для примеси 0330 = 0.5 мг/м3

Расчет проводился на прямоугольнике 1  
 с параметрами: координаты центра X= -3, Y= 3  
 размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480  
 Запрошен учет дифференцированного фона с постов для действующих источников  
 Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
 Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Расшифровка\_обозначений

|                                             |
|---------------------------------------------|
| Qc - суммарная концентрация [доли ПДК]      |
| Cc - суммарная концентрация [мг/м.куб]      |
| Cф - фоновая концентрация [ доли ПДК ]      |
| Cф` - фон без реконструируемых [доли ПДК ]  |
| Cди- вклад действующих (для Cф`) [доли ПДК] |
| Фоп- опасное направл. ветра [ угл. град.]   |
| Uоп- опасная скорость ветра [ м/с ]         |

~~~~~|  
 | -Если в расчете один источник, то его вклад и код не печатаются|  
 | -Если в строке Cmax=< 0.05 ПДК, то Фоп, Uоп, Ви, Ки не печатаются |  
 ~~~~~|

|                                                                                    |
|------------------------------------------------------------------------------------|
| y= 2403 : Y-строка 1 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=135)            |
| -----:                                                                             |
| x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:               |
| -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:           |
| Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  |
| Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  |
| Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  |
| Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: |



Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= 1923 : Y-строка 2 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра=135)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= 1443 : Y-строка 3 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=121)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

y= 963 : Y-строка 4 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=112)

-----:

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:

Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:

Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:

Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:

~~~~~

-----



y= 483 : Y-строка 5 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра=101)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= 3 : Y-строка 6 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -477 : Y-строка 7 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 79)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:  
 Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -957 : Y-строка 8 Cmax= 0.040 долей ПДК (x= 2397.0; напр.ветра=292)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----





```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -1437 : Y-строка 9 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 59)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -1917 : Y-строка 10 Cmax= 0.040 долей ПДК (x= -1923.0; напр.ветра= 45)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:
Cф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

y= -2397 : Y-строка 11 Cmax= 0.040 долей ПДК (x= -2403.0; напр.ветра= 45)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:
Cc : 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020: 0.020:

```



Сф : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сф` : 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040: 0.040:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые
 Расчет проводится в соответствии с документом МРР-2017
 Координаты точки : X= -2403.0 м, Y= 2403.0 м

Максимальная суммарная концентрация | Cs= 0.0400008 доли ПДКмр |
 | 0.0200004 мг/м3 |
 ~~~~~

Достигается при опасном направлении 135 град.  
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада  
 ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код         | Режим | Тип | Выброс                   | Вклад         | Вклад в% | Сум. %                  | Кэф.влияния    |
|------|-------------|-------|-----|--------------------------|---------------|----------|-------------------------|----------------|
| ---- | <Об-П>-<Ис> | ----- | --- | ---М- (Мг) --            | -С [доли ПДК] | -----    | -----                   | ---- b=C/M --- |
|      |             |       |     | Фоновая концентрация Cf` | 0.039999      | 100.0    | (Вклад источников 0.0%) |                |
| 1    | 000101 0001 | 1     | П2  | 0.006200                 | 0.000001      | 100.0    | 100.0                   | 0.000210989    |
|      |             |       |     | В сумме =                | 0.040001      | 100.0    |                         |                |

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:45  
 Примесь :0330 - Серы диоксид  
 ПДКм.р для примеси 0330 = 0.5 мг/м3

\_\_\_\_\_Параметры\_расчетного\_прямоугольника\_No 1\_\_\_\_\_



```

| Координаты центра : X=      -3 м;  Y=      3 |
| Длина и ширина   : L=   4800 м;  B=   4800 м |
| Шаг сетки (dX=dY) : D=    480 м           |

```

~~~~~  
Запрошен учет дифференцированного фона с постов для действующих источников
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

	1	2	3	4	5	6	7	8	9	10	11		
*--													
1-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 1
2-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 2
3-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 3
4-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 4
5-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 5
6-C	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	C- 6
7-	0.040	0.040	0.040	0.040	0.040	0.040 [^]	0.040	0.040	0.040	0.040	0.040	0.040	- 7
8-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 8
9-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	- 9
10-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	-10
11-	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	-11
--													
	1	2	3	4	5	6	7	8	9	10	11		



В целом по расчетному прямоугольнику:

Максимальная концентрация -----> $C_m = 0.0400008$ долей ПДК_{мр}
 $= 0.0200004$ мг/м³
 Достигается в точке с координатами: $X_m = -2403.0$ м
 (X-столбец 1, Y-строка 1) $Y_m = 2403.0$ м
 При опасном направлении ветра : 135 град.
 и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :0330 - Серы диоксид

ПДК_{м.р} для примеси 0330 = 0.5 мг/м³

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

Точка 1. Расчетная точка.

Координаты точки : X= 253.0 м, Y= -1202.0 м

Максимальная суммарная концентрация | $C_s = 0.0400008$ доли ПДК_{мр} |
 | 0.0200004 мг/м³ |
 ~~~~~

Достигается при опасном направлении 348 град.  
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код         | Режим | Тип | Выброс     | Вклад | Вклад в%      | Сум. % | Козф.влияния     |
|------|-------------|-------|-----|------------|-------|---------------|--------|------------------|
| ---- | <Об-П>-<Ис> | ----- | --- | ---М- (Mq) | --    | -С [доли ПДК] | -----  | ----- b=C/M ---- |





|   |             |                          |          |          |                         |       |       |             |  |
|---|-------------|--------------------------|----------|----------|-------------------------|-------|-------|-------------|--|
|   |             | Фоновая концентрация Cf` | 0.039999 | 100.0    | (Вклад источников 0.0%) |       |       |             |  |
| 1 | 000101 0001 | 1                        | П2       | 0.006200 | 0.000001                | 100.0 | 100.0 | 0.000206918 |  |
|   |             | В сумме =                | 0.040001 | 100.0    |                         |       |       |             |  |

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

| Код    | Реж   | Тип | H1        | H2    | D     | Wo    | V1      | T      | X1    | Y1      | X2      | Y2      | Alf     |
|--------|-------|-----|-----------|-------|-------|-------|---------|--------|-------|---------|---------|---------|---------|
| F      | КР    | Ди  | Выброс    | RoГВС |       |       |         |        |       |         |         |         |         |
| <Об~П> | <Ис>  | ~~~ | ~~~       | ~~м~~ | ~~м~~ | ~~м~~ | ~м/с~   | ~м3/с~ | градС | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ | ~~~м~~~ |
| ~~~    | ~~~   | ~~  | ~~г/с~~   | ~~~~  |       |       |         |        |       |         |         |         | гр.     |
| 000101 | 0001  | 1   | П2        | 2.0   | 90.0  | 3.00  | 19085.2 | 20.0   | 5     | 5       | 90      | 90      | 0       |
| 1.0    | 1.250 | 1   | 0.0556000 | 0.000 |       |       |         |        |       |         |         |         |         |

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м3



| - Для линейных и площадных источников выброс является суммарным по всей площади, а $C_m$ - концентрация одиночного источника, расположенного в центре симметрии, с суммарным $M$ |             |       |          |      |               |            |       |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|----------|------|---------------|------------|-------|---------|
| Источники                                                                                                                                                                        |             |       |          |      |               |            |       |         |
| Их расчетные параметры                                                                                                                                                           |             |       |          |      |               |            |       |         |
| Номер                                                                                                                                                                            | Код         | Режим | M        | Тип  | $C_m$         | $U_m$      | $X_m$ |         |
| -п/п-                                                                                                                                                                            | <об-п>-<ис> | ----  | -----    | ---- | - [доли ПДК]- | -- [м/с]-- | ----  | [м]---- |
| 1                                                                                                                                                                                | 000101 0001 | 1     | 0.055600 | П2   | 0.000650      | 386.10     | 294.6 |         |
| Суммарный $M_q = 0.055600$ г/с                                                                                                                                                   |             |       |          |      |               |            |       |         |
| Сумма $C_m$ по всем источникам = 0.000650 долей ПДК                                                                                                                              |             |       |          |      |               |            |       |         |
| -----                                                                                                                                                                            |             |       |          |      |               |            |       |         |
| Средневзвешенная опасная скорость ветра = 386.10 м/с                                                                                                                             |             |       |          |      |               |            |       |         |
| -----                                                                                                                                                                            |             |       |          |      |               |            |       |         |
| Дальнейший расчет нецелесообразен: Сумма $C_m < 0.05$ долей ПДК                                                                                                                  |             |       |          |      |               |            |       |         |

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

| Код загр             | Штиль        | Северное    | Восточное   | Южное       | Западное    |
|----------------------|--------------|-------------|-------------|-------------|-------------|
| вещества             | $U <= 2$ м/с | направление | направление | направление | направление |
| -----                |              |             |             |             |             |
| Пост N 001: X=0, Y=0 |              |             |             |             |             |
| 0337                 | 0.4000000    | 0.4000000   | 0.4000000   | 0.4000000   | 0.4000000   |



| 0.0800000| 0.0800000| 0.0800000| 0.0800000| 0.0800000|

---

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480  
 Расчет в фиксированных точках. Группа точек 090  
 Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
 Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с  
 Средневзвешенная опасная скорость ветра U<sub>св</sub>= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м<sup>3</sup>

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 3

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>mp</sub>) м/с

Расшифровка обозначений

|                                             |
|---------------------------------------------|
| Qс - суммарная концентрация [доли ПДК]      |
| Сс - суммарная концентрация [мг/м.куб]      |
| Сф - фоновая концентрация [ доли ПДК ]      |
| Сф` - фон без реконструируемых [доли ПДК ]  |
| Сди- вклад действующих (для Сф`) [доли ПДК] |
| Фоп- опасное направл. ветра [ угл. град.]   |
| Uоп- опасная скорость ветра [ м/с ]         |

| ~~~~~~ | ~~~~~~ |

| -Если в расчете один источник, то его вклад и код не печатаются|



| -Если в строке Смах=< 0.05 ПДК, то Фоп, Уоп, Ви, Ки не печатаются |

~~~~~

у= 2403 : Y-строка 1 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра=135)
 -----:
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
 Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 Фоп: 135 : 141 : 149 : 158 : 168 : 180 : 191 : 201 : 210 : 219 : 225 :
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
 ~~~~~

у= 1923 : Y-строка 2 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра=129)  
 -----:  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
 Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 129 : 135 : 143 : 153 : 165 : 180 : 194 : 207 : 216 : 225 : 231 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

у= 1443 : Y-строка 3 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра=120)
 -----:
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
 -----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
 Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:



СФ` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 Фоп: 120 : 126 : 135 : 146 : 161 : 180 : 198 : 213 : 225 : 233 : 239 :
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
 ~~~~~

-----  
 у= 963 : Y-строка 4 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра=111)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 СФ : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 СФ` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 111 : 117 : 123 : 135 : 153 : 180 : 206 : 225 : 237 : 243 : 249 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

 у= 483 : Y-строка 5 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра=102)

 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
 СФ : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 СФ` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 Фоп: 102 : 104 : 108 : 116 : 134 : 179 : 225 : 243 : 252 : 256 : 258 :
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
 ~~~~~

-----  
 у= 3 : Y-строка 6 Смах= 0.080 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----



Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 90 : 90 : 90 : 90 : 90 : 48 : 270 : 270 : 270 : 270 : 270 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= -477 : Y-строка 7 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 78)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 Фоп: 78 : 76 : 72 : 63 : 45 : 1 : 315 : 297 : 289 : 284 : 281 :
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
 ~~~~~

y= -957 : Y-строка 8 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 69)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 69 : 63 : 57 : 45 : 27 : 0 : 334 : 315 : 303 : 297 : 292 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= -1437 : Y-строка 9 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 59)



x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 59 : 54 : 45 : 33 : 19 : 0 : 342 : 327 : 315 : 307 : 301 :
Uоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

y= -1917 : Y-строка 10 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 51)

-----  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----  
Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:  
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 51 : 45 : 37 : 27 : 14 : 0 : 346 : 333 : 324 : 315 : 309 :  
Uоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

y= -2397 : Y-строка 11 Cmax= 0.080 долей ПДК (x= -2403.0; напр.ветра= 45)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

Qc : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cф` : 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080: 0.080:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 45 : 39 : 31 : 22 : 12 : 0 : 349 : 338 : 330 : 321 : 315 :
Uоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~



Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
Расчет проводится в соответствии с документом МРР-2017  
Координаты точки : X= -2403.0 м, Y= 2403.0 м

Максимальная суммарная концентрация | Cs= 0.0800007 доли ПДКмр |  
| 0.4000035 мг/м3 |  
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Достигается при опасном направлении 135 град.
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада
ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Коеф. влияния
----	<Об-П>	<Ис>	----	М- (Мг) --	-С [доли ПДК]	-----	-----	b=C/M ---
	Фоновая концентрация Cf`				0.080000	100.0	(Вклад источников 0.0%)	
1	000101	0001	1	П2	0.0556	0.000001	100.0	100.0
				В сумме =	0.080001	100.0		

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые
Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46
Примесь :0337 - Углерода оксид
ПДКм.р для примеси 0337 = 5.0 мг/м3

Параметры_расчетного_прямоугольника_No 1
| Координаты центра : X= -3 м; Y= 3 |
| Длина и ширина : L= 4800 м; В= 4800 м |
| Шаг сетки (dX=dY) : D= 480 м |



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Запрошен учет дифференцированного фона с постов для действующих источников  
Направление ветра: автоматический поиск опасного направления от 0 до 360 град.  
Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Uмр) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)

|     | 1     | 2     | 3     | 4     | 5     | 6                  | 7     | 8     | 9     | 10    | 11    |      |
|-----|-------|-------|-------|-------|-------|--------------------|-------|-------|-------|-------|-------|------|
| *   | ----  | ----  | ----  | ----  | ----  | -----C-----        | ----  | ----  | ----  | ----  | ----  | ---- |
| 1-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 1  |
| 2-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 2  |
| 3-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 3  |
| 4-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 4  |
| 5-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 5  |
| 6-C | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | C- 6 |
| 7-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 <sup>^</sup> | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 7  |
| 8-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 8  |
| 9-  | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | - 9  |
| 10- | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | -10  |
| 11- | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | 0.080              | 0.080 | 0.080 | 0.080 | 0.080 | 0.080 | -11  |
|     | ----  | ----  | ----  | ----  | ----  | -----C-----        | ----  | ----  | ----  | ----  | ----  | ---- |
|     | 1     | 2     | 3     | 4     | 5     | 6                  | 7     | 8     | 9     | 10    | 11    |      |

В целом по расчетному прямоугольнику:  
Максимальная концентрация -----> См = 0.0800007 долей ПДКмр



= 0.4000035 мг/м3  
 Достигается в точке с координатами: Хм = -2403.0 м  
 ( X-столбец 1, Y-строка 1) Ум = 2403.0 м  
 При опасном направлении ветра : 135 град.  
 и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :0337 - Углерода оксид

ПДКм.р для примеси 0337 = 5.0 мг/м3

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0(Умр) м/с

Точка 1. Расчетная точка.

Координаты точки : X= 253.0 м, Y= -1202.0 м

Максимальная суммарная концентрация | Cs= 0.0800007 доли ПДКмр |  
 | 0.4000034 мг/м3 |  
 ~~~~~

Достигается при опасном направлении 348 град.
 и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Козф. влияния
----	<Об-П>	<Ис>	----	М- (Мг)	-С [доли ПДК]	-----	-----	b=C/M
	Фоновая концентрация Cf`			0.080000	0.080000	100.0	(Вклад источников 0.0%)	
1	000101	0001	1	П2	0.0556	0.000001	100.0	100.0
	В сумме =			0.080001	0.080001	100.0		



3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

Код	Реж	Тип	H1	H2	D	Wo	V1	T	X1	Y1	X2	Y2	Alf
F	КР	Ди	Выброс	RoГВС									
<Об~П>	<Ис>	~~~	~~~	~~м~~	~~м~~	~~м~~	~м/с~	~м3/с~	градС	~~~м~~~	~~~м~~~	~~~м~~~	~~~м~~~
000101	0001	1	П2	2.0	90.0	3.00	19085.2	20.0	5	5	90	90	0
1.0	1.250	0	0.0128400	0.000									

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :2754 - Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей |



площади, а C_m – концентрация одиночного источника, расположенного в центре симметрии, с суммарным M

Источники				Их расчетные параметры			
Номер	Код	Режим	M	Тип	C_m	U_m	X_m
-п/п-	<об-п>-<ис>	----	-----	----	- [доли ПДК]-	-- [м/с]--	---- [м]----
1	000101 0001	1	0.012840	П2	0.000751	386.10	294.6
Суммарный $M_q =$			0.012840 г/с				
Сумма C_m по всем источникам =			0.000751 долей ПДК				

Средневзвешенная опасная скорость ветра = 386.10 м/с							

Дальнейший расчет нецелесообразен: Сумма $C_m < 0.05$ долей ПДК							

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :2754 – Углеводороды предельные C12-C-19

ПДКм.р для примеси 2754 = 1.0 мг/м3

Фоновая концентрация не задана

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{mp}) м/с

Средневзвешенная опасная скорость ветра $U_{св} = 386.1$ м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые



Расчет проводится в соответствии с документом МРР-2017
Город :042 Мегри.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46
Примесь :2754 - Углеводороды предельные C12-C-19
ПДКм.р для примеси 2754 = 1.0 мг/м3

Расчет не проводился: См < 0.05 долей ПДК

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46
Примесь :2754 - Углеводороды предельные C12-C-19
ПДКм.р для примеси 2754 = 1.0 мг/м3

Расчет не проводился: См < 0.05 долей ПДК

10. Результаты расчета в фиксированных точках..

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.
Объект :0001 Строительная площадка.
Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46
Примесь :2754 - Углеводороды предельные C12-C-19
ПДКм.р для примеси 2754 = 1.0 мг/м3

Расчет не проводился: См < 0.05 долей ПДК



3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :2902 - Взвешенные вещества
ПДКм.р для примеси 2902 = 0.5 мг/м3

Коэффициент рельефа (КР): индивидуальный с источников

Коэффициент оседания (F): индивидуальный с источников

Код	Реж	Тип	H1	H2	D	Wo	V1	T	X1	Y1	X2	Y2	Alf
F	КР	Ди	Выброс	RoГВС									
<Об~П>	<Ис>	~~~	~~~	~~м~~	~~м~~	~~м~~	~м/с~	~м3/с~	градС	~~~м~~~~	~~~м~~~~	~~~м~~~~	~~~м~~~~
~~~	~~~	~~	~~~г/с~~~	~~~~~									гр.
000101	0001	1	П2	2.0	90.0	3.00	19085.2	20.0	5	5	90	90	0
3.0	1.250	1	0.0726600	0.000									

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :2902 - Взвешенные вещества  
ПДКм.р для примеси 2902 = 0.5 мг/м3

| - Для линейных и площадных источников выброс является суммарным по всей |  
| площади, а См - концентрация одиночного источника, расположенного в |  
| центре симметрии, с суммарным М |  
| ~~~~~~ |



Источники					Их расчетные параметры		
Номер	Код	Режим	М	Тип	См	Um	Xm
-п/п-	<об-п>	<ис>			[доли ПДК]	[м/с]	[м]
1	000101	0001	1	П2	0.025496	386.10	147.3
Суммарный Mq = 0.072660 г/с Сумма См по всем источникам = 0.025496 долей ПДК							
Средневзвешенная опасная скорость ветра = 386.10 м/с							
Дальнейший расчет нецелесообразен: Сумма См < 0.05 долей ПДК							

5. Управляющие параметры расчета

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Сезон :ЛЕТО (температура воздуха 26.3 град.С)

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м3

Фоновая концентрация на постах (в мг/м3 / долях ПДК)

Код загр	Штиль	Северное	Восточное	Южное	Западное
вещества	U<=2м/с	направление	направление	направление	направление
Пост N 001: X=0, Y=0					
2902	0.2000000	0.2000000	0.2000000	0.2000000	0.2000000
	0.4000000	0.4000000	0.4000000	0.4000000	0.4000000

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.



Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{mp}) м/с  
Средневзвешенная опасная скорость ветра U_{св}= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м³

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 3

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{mp}) м/с

Расшифровка_обозначений

Qс - суммарная концентрация [доли ПДК]	
Сс - суммарная концентрация [мг/м.куб]	
Сф - фоновая концентрация [ доли ПДК ]	
Сф` - фон без реконструируемых [доли ПДК ]	
Сди- вклад действующих (для Сф`) [доли ПДК]	
Фоп- опасное направл. ветра [ угл. град.]	
Уоп- опасная скорость ветра [ м/с ]	

| ~~~~~~ |  
| -Если в расчете один источник, то его вклад и код не печатаются |  
| -Если в строке Смах=< 0.05 ПДК, то Фоп, Уоп, Ви, Ки не печатаются |  
| ~~~~~~ |

y= 2403 : Y-строка 1 Смах= 0.400 долей ПДК (x= -2403.0; напр.ветра=135)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:





```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 135 : 141 : 149 : 158 : 168 : 180 : 191 : 202 : 211 : 219 : 225 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= 1923 : Y-строка 2 Cmax= 0.400 долей ПДК (x= -1923.0; напр.ветра=135)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 129 : 135 : 143 : 153 : 166 : 180 : 194 : 206 : 217 : 225 : 231 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```

y= 1443 : Y-строка 3 Cmax= 0.400 долей ПДК (x= 2397.0; напр.ветра=239)

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

```

```

-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
Фоп: 121 : 127 : 135 : 146 : 161 : 180 : 198 : 213 : 225 : 233 : 239 :
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :
~~~~~

```



y= 963 : Y-строка 4 Cmax= 0.400 долей ПДК (x= 2397.0; напр.ветра=248)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 112 : 116 : 123 : 135 : 153 : 180 : 206 : 225 : 236 : 243 : 248 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= 483 : Y-строка 5 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра=101)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 101 : 104 : 108 : 116 : 134 : 179 : 225 : 243 : 252 : 256 : 259 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

y= 3 : Y-строка 6 Cmax= 0.400 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 90 : 90 : 90 : 90 : 90 : 47 : 270 : 270 : 270 : 270 : 270 :  
 ~~~~~



Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

у= -477 : Y-строка 7 Смах= 0.400 долей ПДК (x= -2403.0; напр.ветра= 79)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 79 : 76 : 72 : 64 : 45 : 1 : 316 : 297 : 289 : 284 : 281 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

у= -957 : Y-строка 8 Смах= 0.400 долей ПДК (x= 2397.0; напр.ветра=292)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cф` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
Фоп: 68 : 63 : 56 : 45 : 27 : 0 : 334 : 315 : 304 : 297 : 292 :  
Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
~~~~~

у= -1437 : Y-строка 9 Смах= 0.400 долей ПДК (x= -2403.0; напр.ветра= 59)

-----:  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
Cф : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:



СФ` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 59 : 53 : 45 : 34 : 19 : 0 : 342 : 327 : 315 : 307 : 301 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

-----  
 у= -1917 : Y-строка 10 Сmax= 0.400 долей ПДК (x= 1917.0; напр.ветра=315)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 СФ : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 СФ` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 51 : 45 : 37 : 27 : 14 : 0 : 346 : 334 : 323 : 315 : 309 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

-----  
 у= -2397 : Y-строка 11 Сmax= 0.400 долей ПДК (x= -2403.0; напр.ветра= 45)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Cc : 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200: 0.200:  
 СФ : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 СФ` : 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400: 0.400:  
 Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 Фоп: 45 : 39 : 31 : 22 : 11 : 0 : 349 : 338 : 329 : 321 : 315 :  
 Уоп:25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :25.00 :  
 ~~~~~

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017  
 Координаты точки : X= -2403.0 м, Y= 2403.0 м





Максимальная суммарная концентрация | Cs= 0.4000276 доли ПДКмр |  
| 0.2000138 мг/м3 |  
~~~~~

Достигается при опасном направлении 135 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Кэф. влияния
----	<Об-П>	<Ис>	----	М- (Мг)	-С [доли ПДК]	-----	-----	b=C/M
	Фоновая концентрация Cf`				0.399982	100.0	(Вклад источников 0.0%)	
1	000101	0001	1	П2	0.0727	0.000046	100.0	100.0
				В сумме =	0.400028	100.0		

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :2902 - Взвешенные вещества  
ПДКм.р для примеси 2902 = 0.5 мг/м3

Параметры расчетного прямоугольника No 1

| Координаты центра : X= -3 м; Y= 3 |  
| Длина и ширина : L= 4800 м; B= 4800 м |  
| Шаг сетки (dX=dY) : D= 480 м |  
~~~~~

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (Uмр) м/с

(Символ ^ означает наличие источника вблизи расчетного узла)



|                                                                          | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |
|--------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| *----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- |       |       |       |       |       | C     |       |       |       |       |       |      |
| 1-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 1  |
| 2-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 2  |
| 3-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 3  |
| 4-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 4  |
| 5-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 5  |
| 6-C                                                                      | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | C- 6 |
| 7-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 7  |
| 8-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 8  |
| 9-                                                                       | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | - 9  |
| 10-                                                                      | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | -10  |
| 11-                                                                      | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | 0.400 | -11  |
| ----- ----- ----- ----- ----- ----- ----- ----- ----- ----- -----        |       |       |       |       |       | C     |       |       |       |       |       |      |
|                                                                          | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |      |

В целом по расчетному прямоугольнику:

Максимальная концентрация ----->  $C_m = 0.4000276$  долей ПДК<sub>мр</sub>  
 $= 0.2000138$  мг/м<sup>3</sup>

Достигается в точке с координатами:  $X_m = -2403.0$  м  
 ( X-столбец 1, Y-строка 1)  $Y_m = 2403.0$  м

При опасном направлении ветра : 135 град.  
 и "опасной" скорости ветра : 25.00 м/с



10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вер.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Примесь :2902 - Взвешенные вещества

ПДКм.р для примеси 2902 = 0.5 мг/м3

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Точка 1. Расчетная точка.

Координаты точки : X= 253.0 м, Y= -1202.0 м

Максимальная суммарная концентрация | Cs= 0.4000271 доли ПДК<sub>мр</sub> |  
| 0.2000135 мг/м3 |

~~~~~

Достигается при опасном направлении 348 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Кэф. влияния
				М- (Мг)	-С [доли ПДК]			b=C/M
				Фоновая концентрация Cf`	0.399982	100.0	(Вклад источников 0.0%)	
1	000101 0001	1	П2	0.0727	0.000045	100.0	100.0	0.000620754
				В сумме =	0.400027	100.0		

3. Исходные параметры источников.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017



Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46  
 Группа суммации :6204=0301 Азота диоксид  
 0330 Серы диоксид  
 Коэфф. комбинированного действия = 1.60

Коэффициент рельефа (КР): индивидуальный с источников  
 Коэффициент оседания (F): индивидуальный с источников

Код	Реж	Тип	H1	H2	D	Wo	V1	T	X1	Y1	X2	Y2	Alf
F	КР	Ди	Выброс	RoГВС									
<Об~П>	<Ис>	~~~	~~~	~~м~~	~~м~~	~~м~~	~м/с~	~м3/с~	градС	~~~м~~~	~~~м~~~	~~~м~~~	~~~м~~~
~~~	~~~	~~	~~г/с~~	~~~~									
----- Примесь 0301-----													
000101	0001	1	П2	2.0	90.0	3.00	19085.2	20.0	5	5	90	90	0
1.0	1.250	1	0.0648000	0.000									
----- Примесь 0330-----													
000101	0001	1	П2	2.0	90.0	3.00	19085.2	20.0	5	5	90	90	0
1.0	1.250	1	0.0062000	0.000									

4. Расчетные параметры См, Ум, Хм

ПК ЭРА v3.0. Модель: Разовые  
 Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.  
 Объект :0001 Строительная площадка.  
 Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46  
 Сезон :ЛЕТО (температура воздуха 26.3 град.С)  
 Группа суммации :6204=0301 Азота диоксид  
 0330 Серы диоксид  
 Коэфф. комбинированного действия = 1.60

| - Для групп суммации выброс  $M_q = M1/ПДК1 + \dots + Mn/ПДКn$ , а суммарная |







	0.0400000	0.0400000	0.0400000	0.0400000	0.0400000
0330	0.0200000	0.0200000	0.0200000	0.0200000	0.0200000
	0.0400000	0.0400000	0.0400000	0.0400000	0.0400000

Расчет по прямоугольнику 001 : 4800x4800 с шагом 480

Расчет в фиксированных точках. Группа точек 090

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

Средневзвешенная опасная скорость ветра U_{св}= 386.1 м/с

6. Результаты расчета в виде таблицы.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Коэфф. комбинированного действия = 1.60

Расчет проводился на прямоугольнике 1

с параметрами: координаты центра X= -3, Y= 3

размеры: длина (по X)= 4800, ширина (по Y)= 4800, шаг сетки= 480

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U_{мр}) м/с

Расшифровка_обозначений

Qс - суммарная концентрация [доли ПДК]
Сф - фоновая концентрация [ доли ПДК ]
Сф` - фон без реконструируемых [доли ПДК ]
Сди- вклад действующих (для Сф`) [доли ПДК]
Фоп- опасное направл. ветра [ угл. град.]
Uоп- опасная скорость ветра [ м/с ]



```

| 301- % вклада NO2 в суммарную концентрацию |
|~~~~~|~~~~~|
| -При расчете по группе суммации концентр. в мг/м3 не печатается|
| -Если в расчете один источник, то его вклад и код не печатаются|
| -Если в строке Смах=< 0.05 ПДК, то Фоп, Уоп, Ви, Ки не печатаются |
|~~~~~|~~~~~|

```

```

y= 2403 : Y-строка 1 Смах= 0.050 долей ПДК (x= 2397.0; напр.ветра=225)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

```

-----
y= 1923 : Y-строка 2 Смах= 0.050 долей ПДК (x= -1923.0; напр.ветра=135)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

```

y= 1443 : Y-строка 3 Смах= 0.050 долей ПДК (x= 2397.0; напр.ветра=239)
-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```



y= 963 : Y-строка 4 Cmax= 0.050 долей ПДК (x= 2397.0; напр.ветра=248)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= 483 : Y-строка 5 Cmax= 0.050 долей ПДК (x= -2403.0; напр.ветра=101)

 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
 ~~~~~

y= 3 : Y-строка 6 Cmax= 0.050 долей ПДК (x= -2403.0; напр.ветра= 90)  
 -----  
 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
 -----  
 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
 Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
 ~~~~~

y= -477 : Y-строка 7 Cmax= 0.050 долей ПДК (x= -2403.0; напр.ветра= 79)

 x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:

 Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
 ~~~~~





Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
~~~~~

y= -957 : Y-строка 8 Стах= 0.050 долей ПДК (x= 2397.0; напр.ветра=292)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

-----  
y= -1437 : Y-строка 9 Стах= 0.050 долей ПДК (x= -2403.0; напр.ветра= 59)  
-----  
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:  
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:  
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:  
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:  
~~~~~

y= -1917 : Y-строка 10 Стах= 0.050 долей ПДК (x= 2397.0; напр.ветра=309)

x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Сди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

-----  
y= -2397 : Y-строка 11 Стах= 0.050 долей ПДК (x= -2403.0; напр.ветра= 45)  
-----



```

-----:
x= -2403 : -1923: -1443: -963: -483: -3: 477: 957: 1437: 1917: 2397:
-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:-----:
Qc : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cф` : 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050: 0.050:
Cди: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000: 0.000:
~~~~~

```

Условие на доминирование NO2 (0301)  
в 2-компонентной группе суммации 6204  
ВЫПОЛНЕНО (вклад NO2 > 80%) во всех 121 расчетных точках.  
Группу суммации можно НЕ УЧИТЫВАТЬ (примеч. 5 к гл. I СП 1.2.3685-21).

Результаты расчета в точке максимума ПК ЭРА v3.0. Модель: Разовые  
Расчет проводится в соответствии с документом МРР-2017  
Координаты точки : X= 2397.0 м, Y= 2403.0 м

Максимальная суммарная концентрация | Cs= 0.0500133 доли ПДКмр |  
~~~~~

Достигается при опасном направлении 225 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

ВКЛАДЫ ИСТОЧНИКОВ

| Ном. | Код         | Режим | Тип | Выброс    | Вклад    | Вклад в% | Сум. % | Кэф. влияния |
|------|-------------|-------|-----|-----------|----------|----------|--------|--------------|
| 1    | 000101 0001 | 1     | П2  | 0.2103    | 0.000022 | 100.0    | 100.0  | 0.000105507  |
|      |             |       |     | В сумме = | 0.050013 | 100.0    |        |              |

7. Суммарные концентрации в узлах расчетной сетки.

ПК ЭРА v3.0. Модель: Разовые  
Расчет проводится в соответствии с документом МРР-2017

Город : 042 Мегри.  
Объект : 0001 Строительная площадка.





|     |       |       |       |       |       |       |       |       |       |       |       |     |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| 10- | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | -10 |
| 11- | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | -11 |
|     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    |     |

В целом по расчетному прямоугольнику:

Безразмерная макс. концентрация --->  $C_m = 0.0500133$   
 Достигается в точке с координатами:  $X_m = 2397.0$  м  
 ( X-столбец 11, Y-строка 1)  $Y_m = 2403.0$  м  
 При опасном направлении ветра : 225 град.  
 и "опасной" скорости ветра : 25.00 м/с

10. Результаты расчета в фиксированных точках.

ПК ЭРА v3.0. Модель: Разовые

Расчет проводится в соответствии с документом МРР-2017

Группа точек 090

Город :042 Мегри.

Объект :0001 Строительная площадка.

Вар.расч. :1 Расч.год: 2021 (СП) Расчет проводился 23.08.2021 20:46

Группа суммации :6204=0301 Азота диоксид

0330 Серы диоксид

Коэфф. комбинированного действия = 1.60

Запрошен учет дифференцированного фона с постов для действующих источников

Направление ветра: автоматический поиск опасного направления от 0 до 360 град.

Скорость ветра: автоматический поиск опасной скорости от 0.5 до 25.0 (U<sub>мр</sub>) м/с

Точка 1. Расчетная точка.

Координаты точки :  $X = 253.0$  м,  $Y = -1202.0$  м

Максимальная суммарная концентрация |  $C_s = 0.0500131$  доли ПДК<sub>мр</sub> |  
 ~~~~~





Достигается при опасном направлении 348 град.  
и скорости ветра 25.00 м/с

Всего источников: 1. В таблице заказано вкладчиков не более чем с 95% вклада

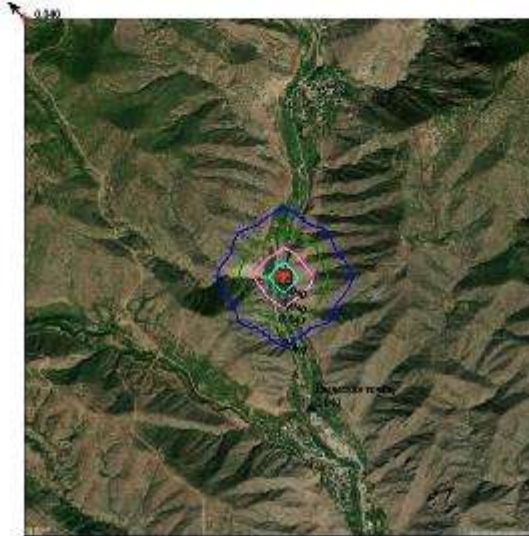
ВКЛАДЫ ИСТОЧНИКОВ

Ном.	Код	Режим	Тип	Выброс	Вклад	Вклад в%	Сум. %	Кэф.влияния
----	<Об-П>-<Ис>	-----	---	М- (Mq) --	-С [доли ПДК]	-----	-----	b=C/M ---
				Фоновая концентрация Cf`	0.049991	100.0	(Вклад источников 0.0%)	
1	000101 0001	1	П2	0.2103	0.000022	100.0	100.0	0.000103459
				В сумме =	0.050013	100.0		

~~~~~



Горуд : 942 Метри  
Објект : 0001 Стратегијски плановски Вар.Ж 1  
ПК ФРА v3.0, Модел: MPP-2017  
0301 Азота диоксид



- Услови и објекти:
- Горуд (градско подрачје)
  - Републички парк, одок N 02
  - Мноштво заштитених објеката
  - Покр. категорија земл. N 01

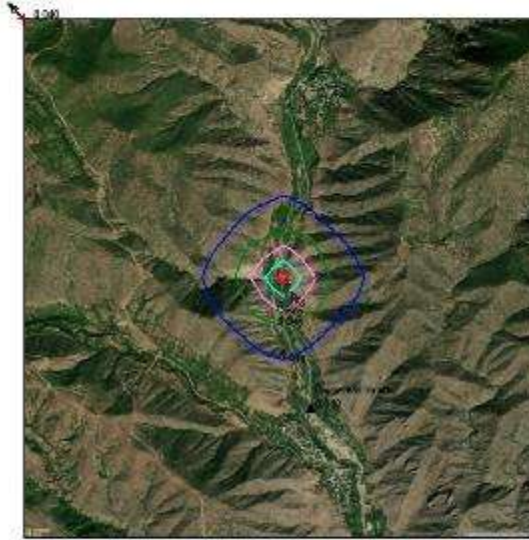
- Нивоци в. датум (ДК)
- 0.100
  - 0.200
  - 0.300
  - 0.500



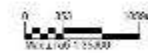
Подготовка програма: 1 - Станис  
Начелник на ЈЗП 0102005 ПЗП, датум издања в. датум од 2010. год 2000.  
Пројектни ниво: 1:25000 и 1:50000 од датум издања 2010. год.  
Пројектни ниво: 1:25000 и 1:50000 од датум издања 2010. год.  
Пројектни ниво: 1:25000 и 1:50000 од датум издања 2010. год.  
Пројектни ниво: 1:25000 и 1:50000 од датум издања 2010. год.



Город : 042 Мегри  
Објект : 0001 Структурни проект за изградба на Водосток  
ПК ЗРА v3.0. Модул : МРР-2017  
0330 Серви проект



- |                                    |                       |
|------------------------------------|-----------------------|
| Условни објекти:                   | Условни адреси Г.Д.К. |
| □ Територијално одрежување         | □ 042 Г.Д.К.          |
| □ Релевни линији, нивоа 5, 90      | □ 042 Г.Д.К.          |
| □ Планирање и изградба на водосток | □ 042 Г.Д.К.          |
| □ Покривеност, NOT                 | □ 042 Г.Д.К.          |



Член 10(4) од Законот за животна средина  
Условна документација (УД) за предметот на овој проект – 042 – 042  
Деловоден документ 1007 подготвен според член 25 од  
Законот за животна средина, вкупно 4830 м. квадратни метри  
за проектот со вкупна вредност од околу 11.111  
Машина бр. 042/042/042/042









Город : 042 Мегри  
Објект : 0101 Структурни проект за проект Вар № 1  
ПК ЗРА v3.0. Модул : MPP-2017  
5204 0301+0330

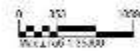


Условни објекти:

- Структурни проект за проект
- Проект за траса, ширина 8,00
- Планирање за изградба на автопат
- Гранична линија на проектот

Условни објекти:

- 1.000 Т.О.К.
- 2.000 Т.О.К.
- 3.000 Т.О.К.
- 4.000 Т.О.К.



Начин на издавање на проектот : Црвена  
Условна скала : 1:10000  
Својата скала : 1:10000  
Својата скала : 1:10000  
Својата скала : 1:10000  
Својата скала : 1:10000





**ANNEX 17: KAJARAN-AGARAK ROAD DETAILS MAPS INCLUDING INFRASTRUCTURES**



Figure 127: Lot 1, part 1



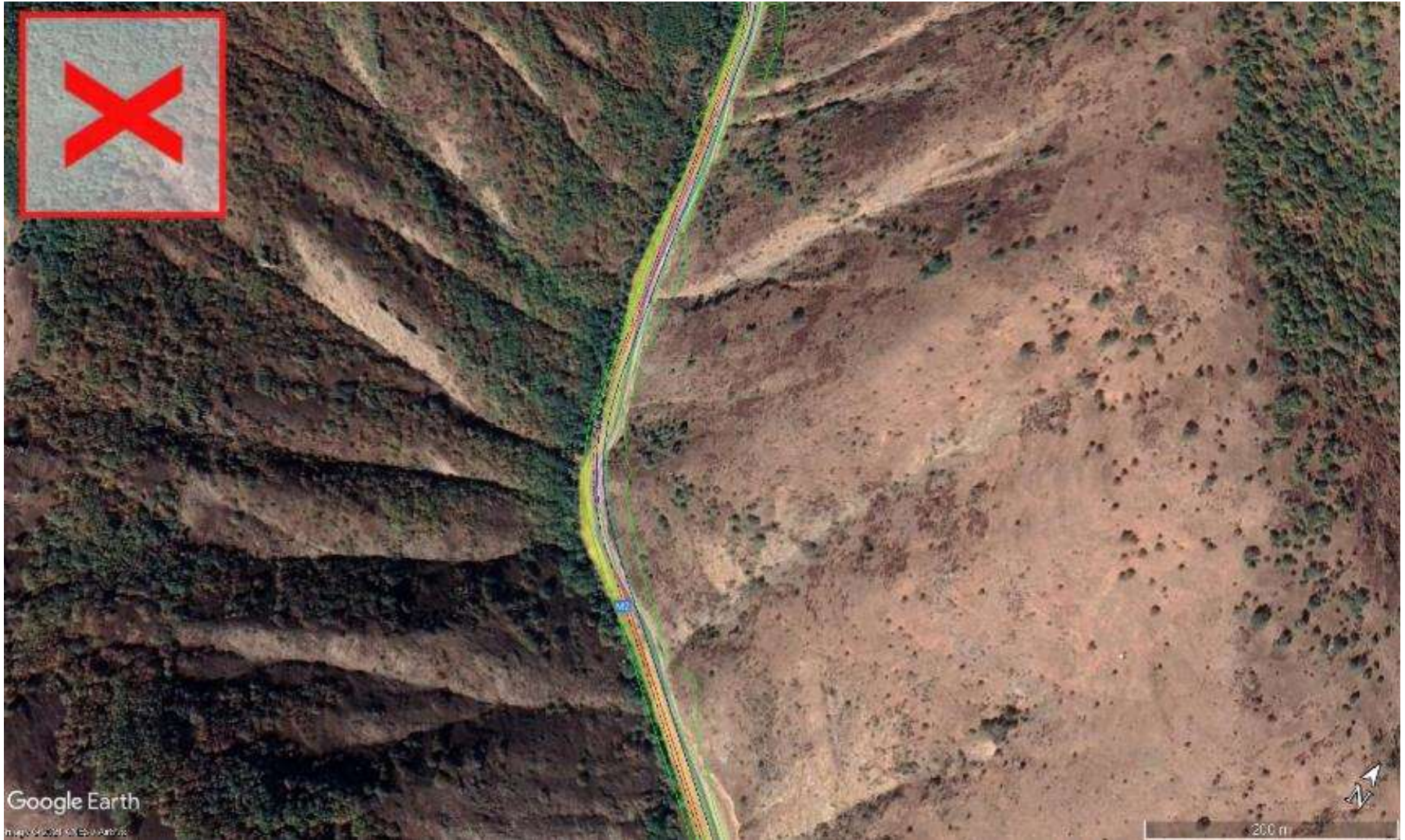


Figure 128: Lot 1, part 2





Figure 129: Lot 1, part 3





Figure 130: Lot 1, part 4





Figure 131: Lot 1, part 5





Figure 132: Lot 1, part 6



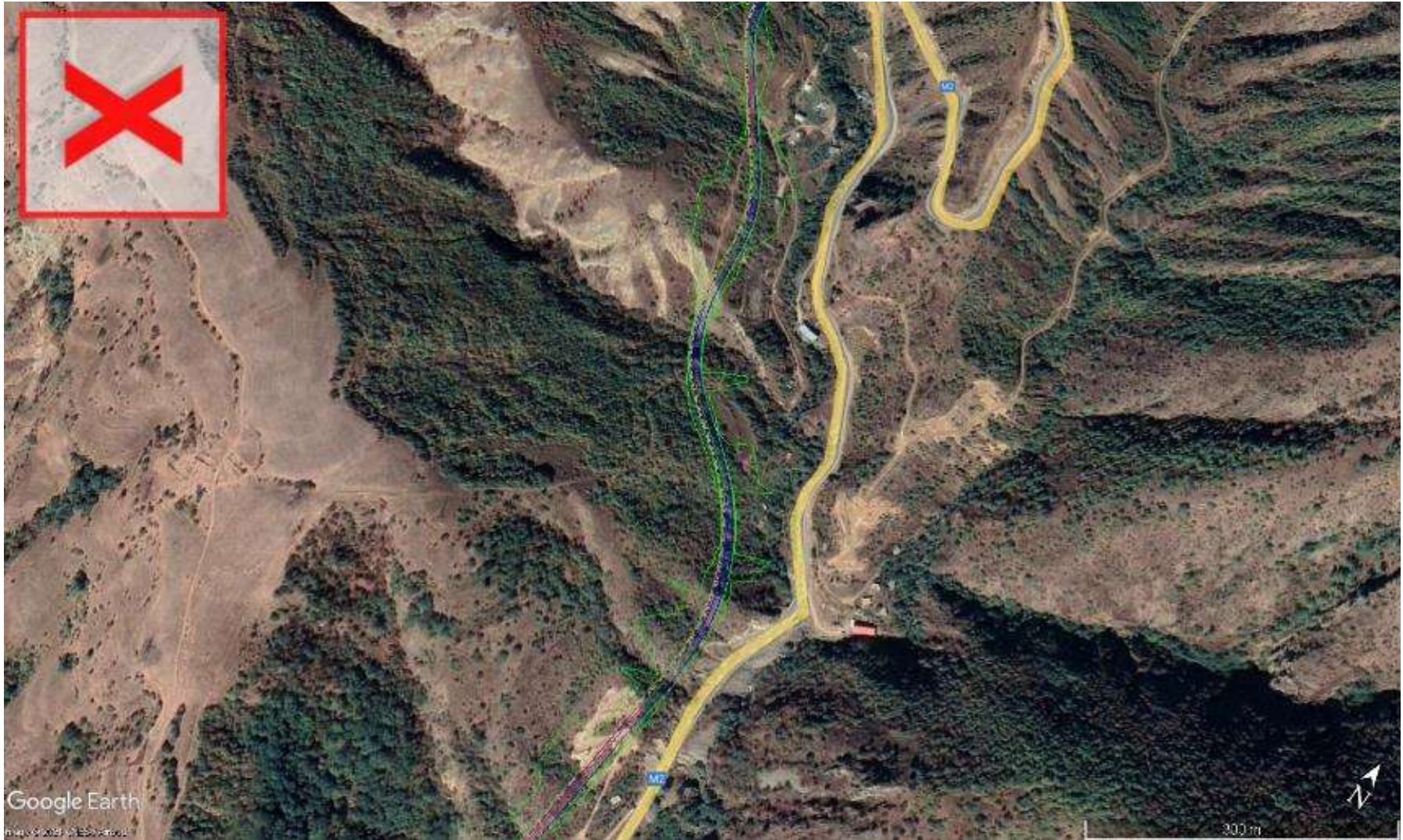


Figure 133: Lot 1, part 7



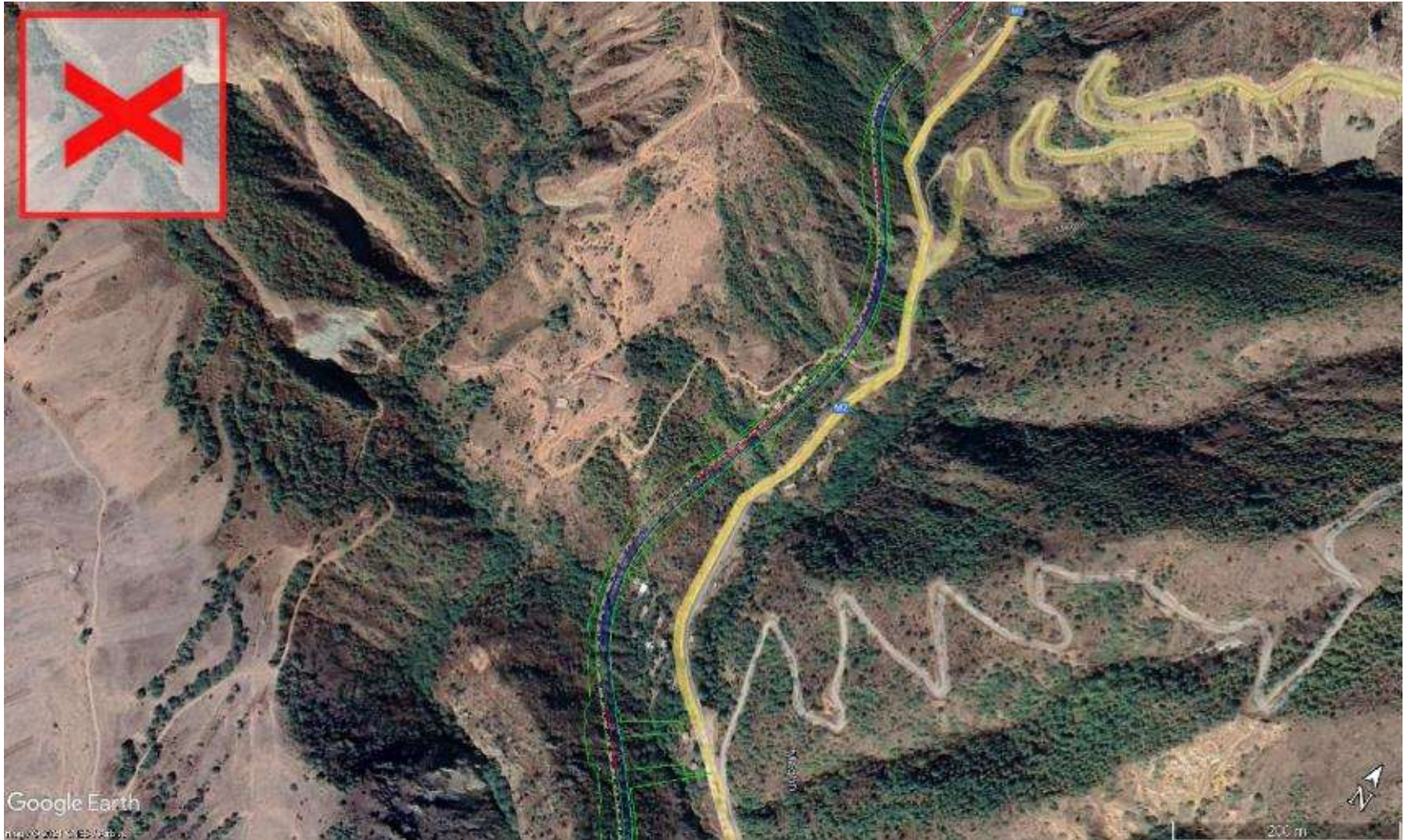


Figure 134: Lot 1, part 8





Figure 135: Lot 1, part 9





Figure 136: Lot 1, part 10





Figure 137: Lot 1, part 11





Figure 138: Lot 1, part 12





Figure 139: Lot 1, part 13





Figure 140: Lot 1, part 14





Figure 141: Lot 1, part 15





Figure 142: Lot 1, part 16





Figure 143: Lot 1, part 17



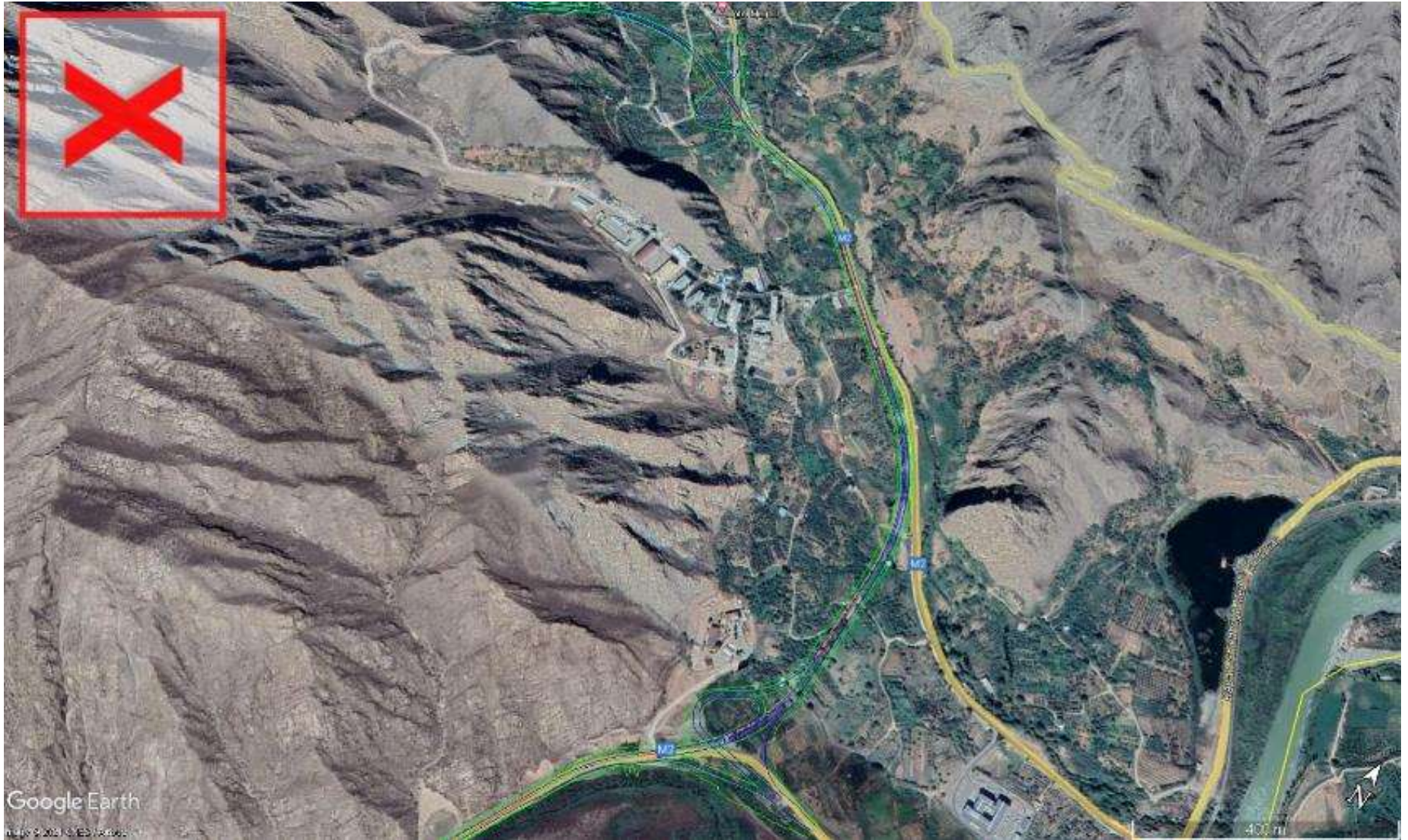


Figure 144: Lot 1, part 18





Figure 145: Lot 1, part 19





Figure 146: Lot 1, part 20





Figure 147: Lot 1, part 21





Figure 148: Lot 2, part 1





Figure 149: Lot 2, part 2





Figure 150: Lot 2, part 3





Figure 151: Lot 2, part 4







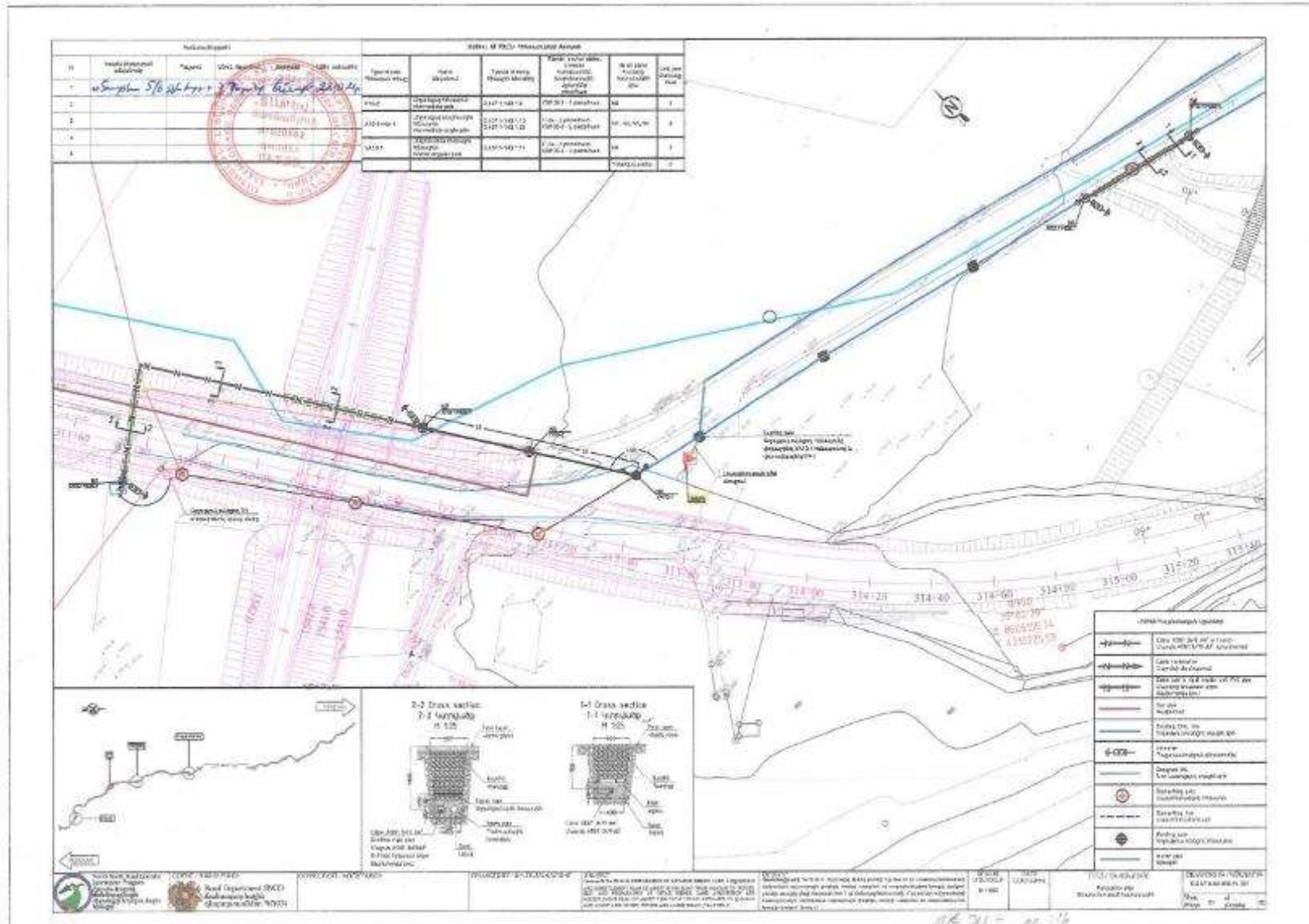


Figure 153

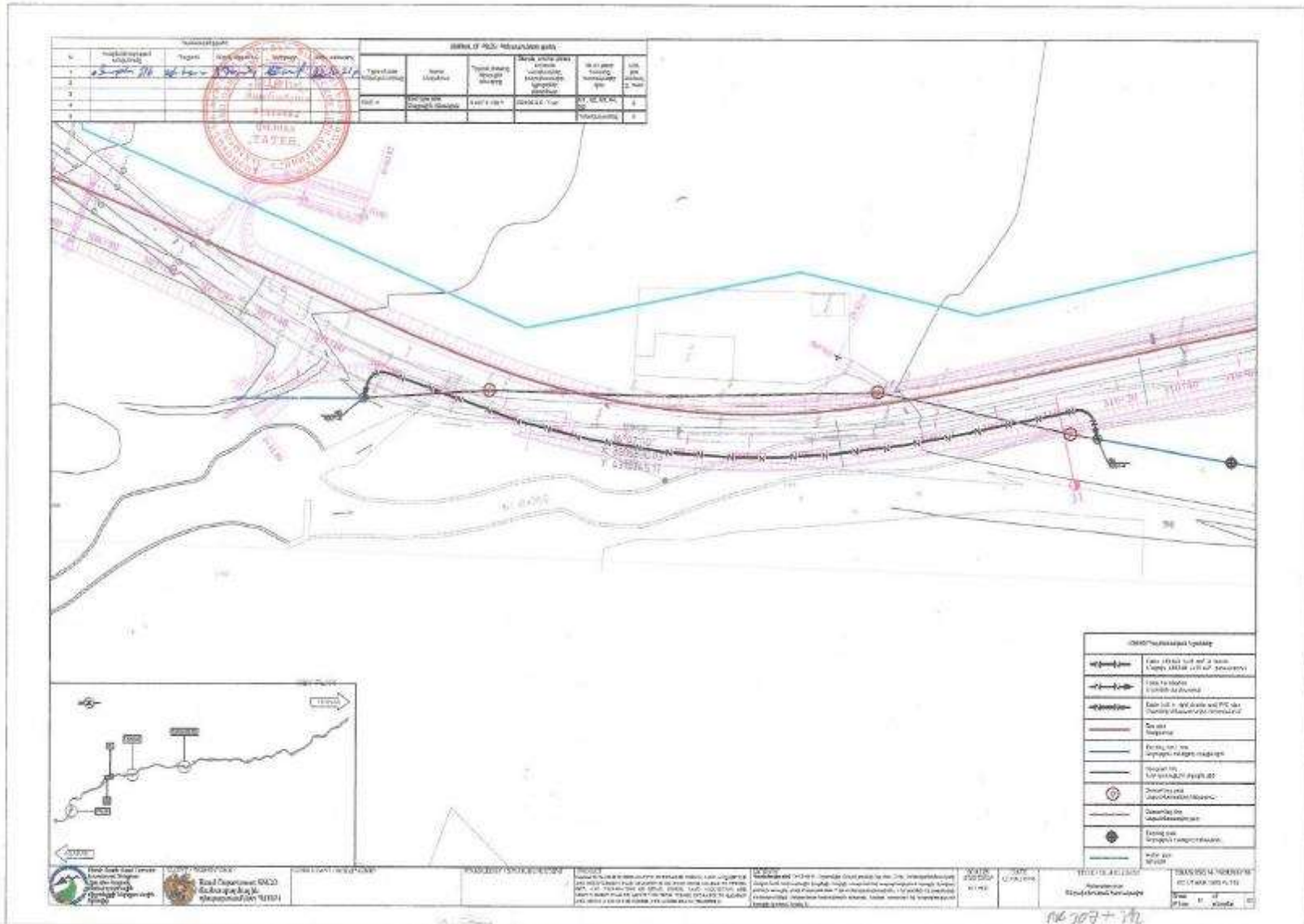


Figure 154

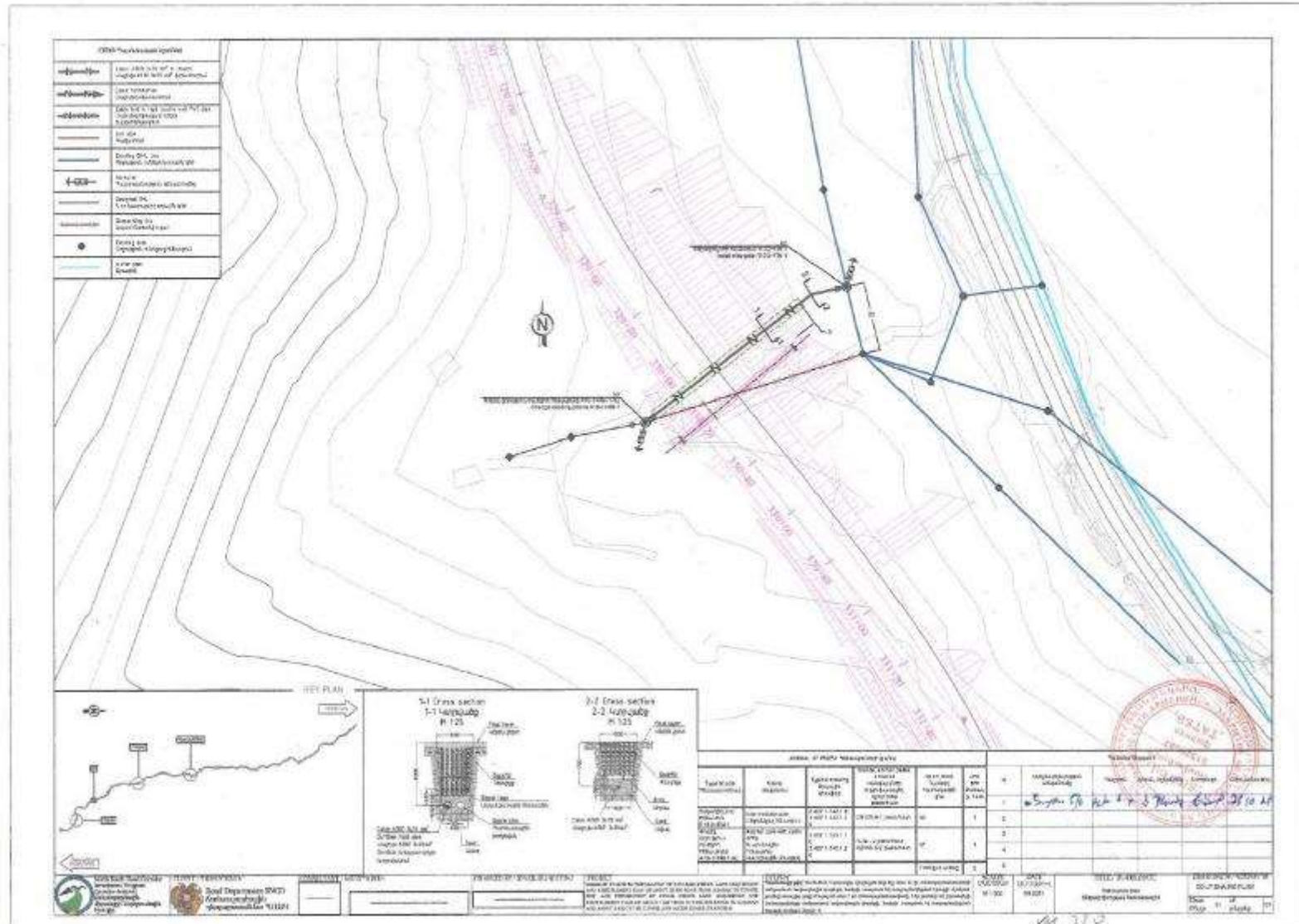


Figure 155



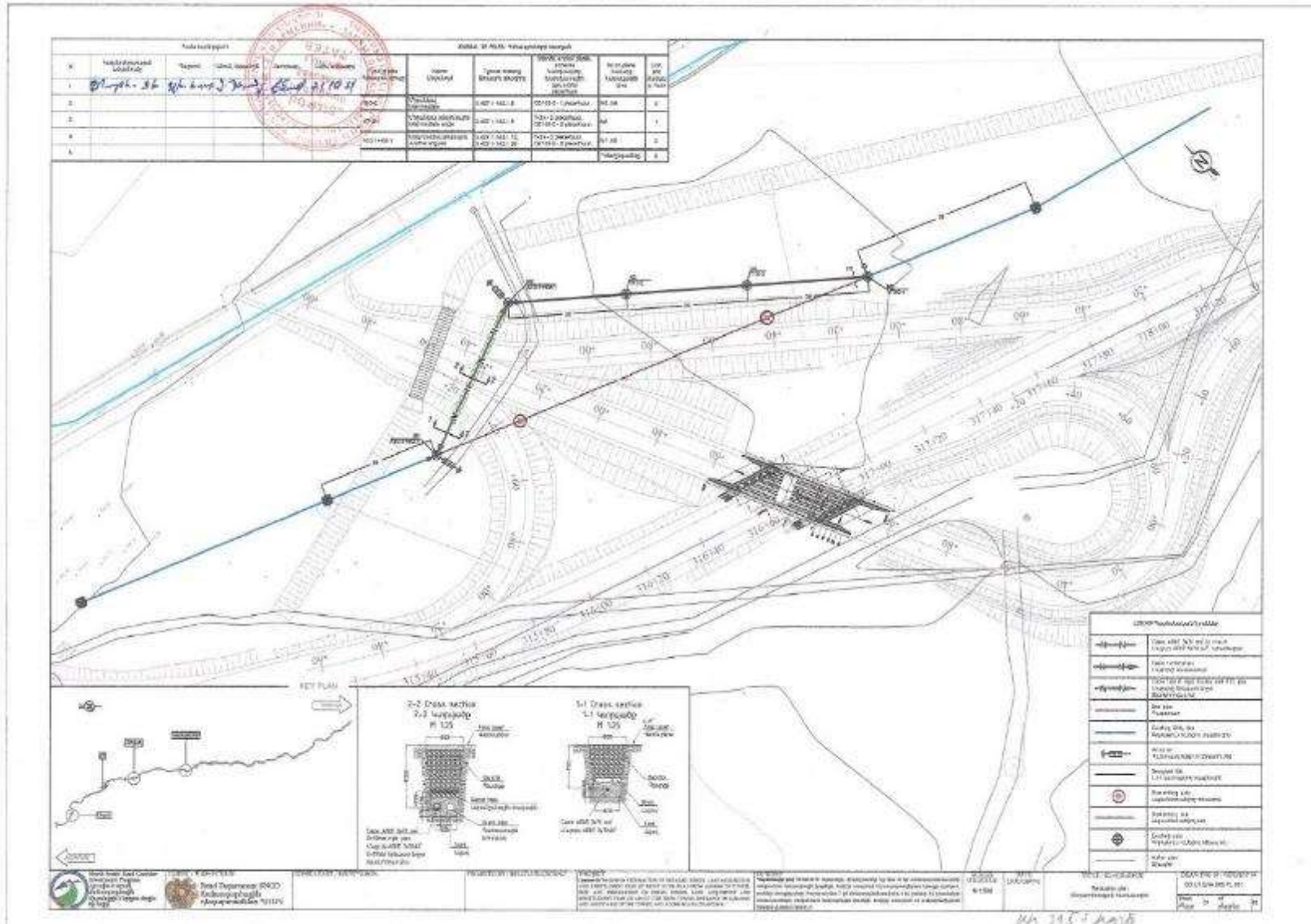


Figure 156



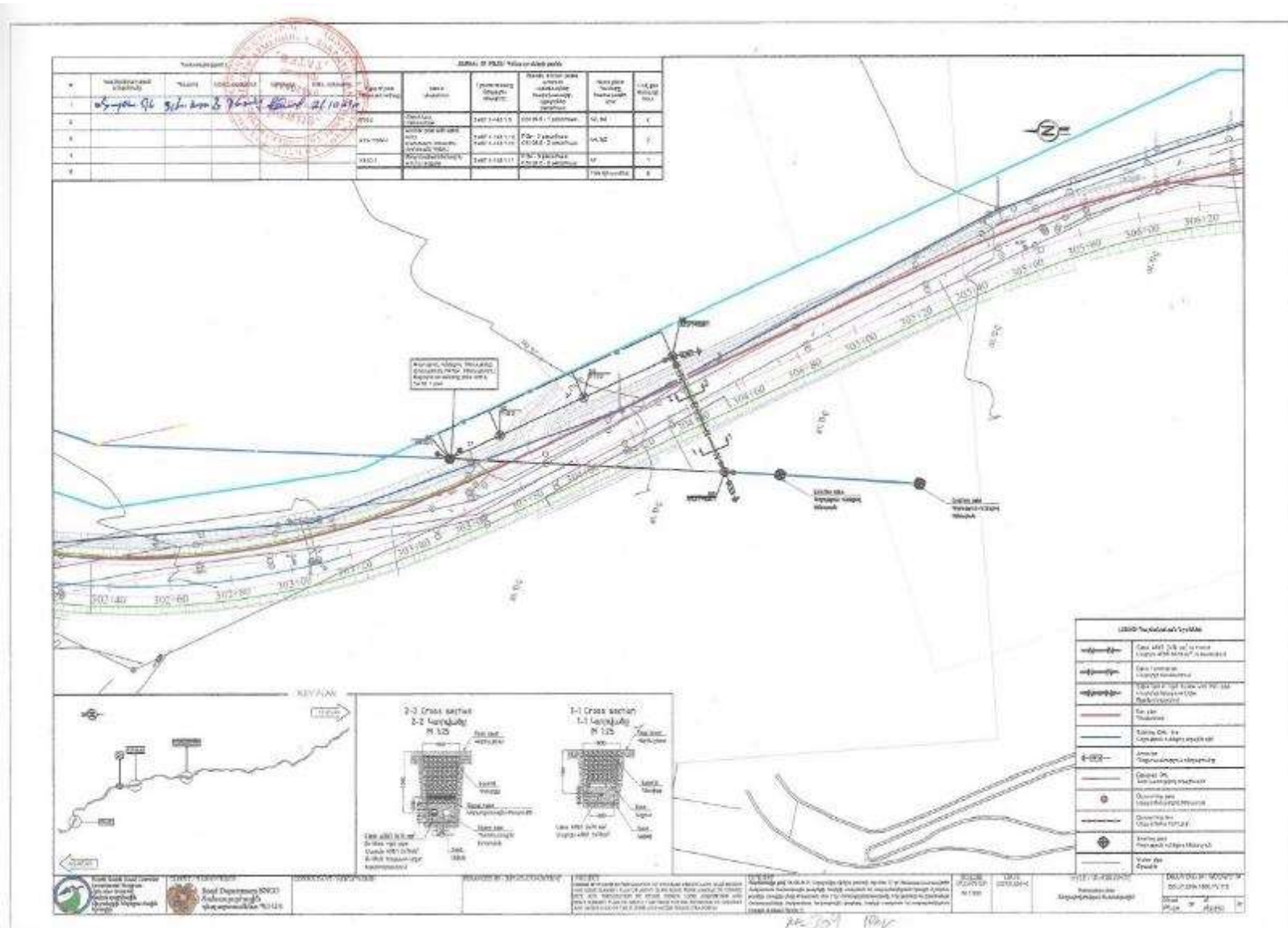


Figure 157









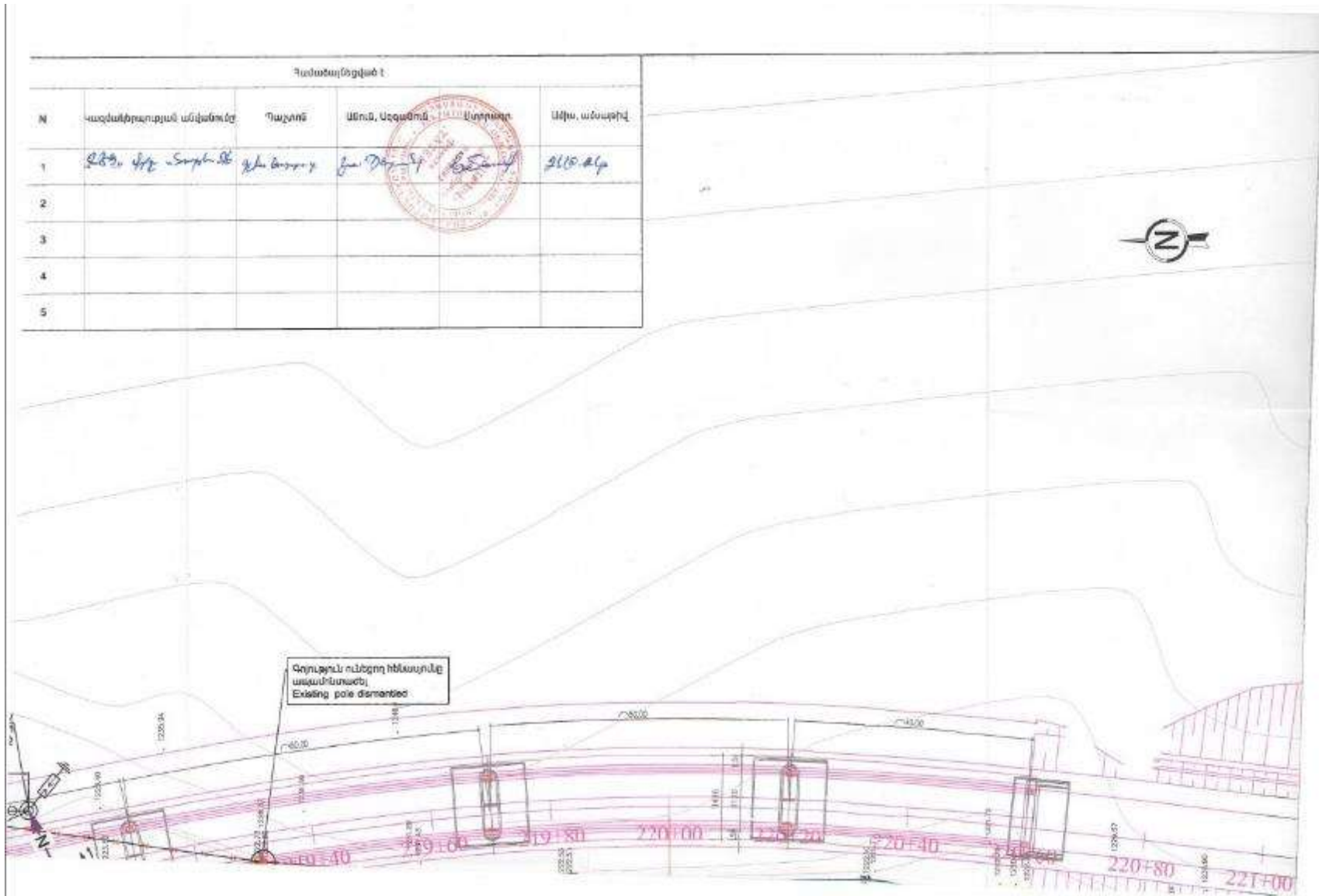


Figure 161



Figure 162



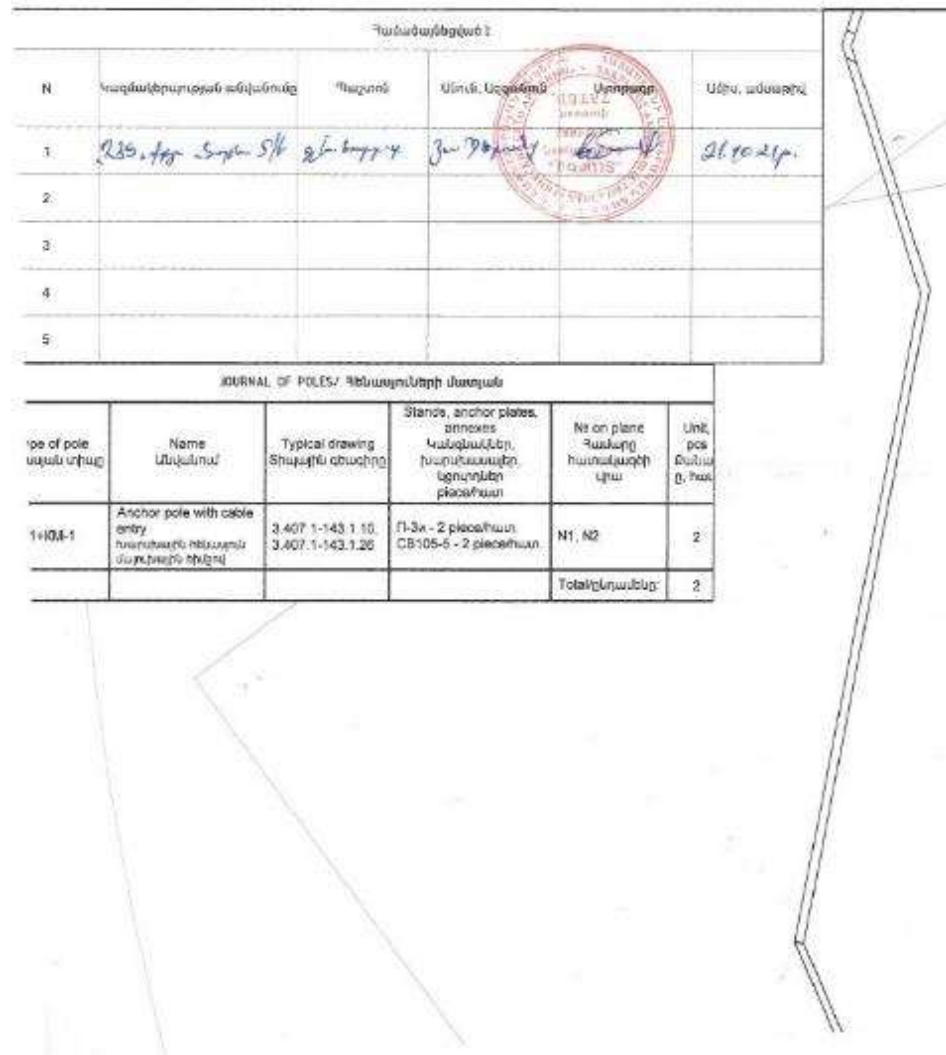


Figure 164



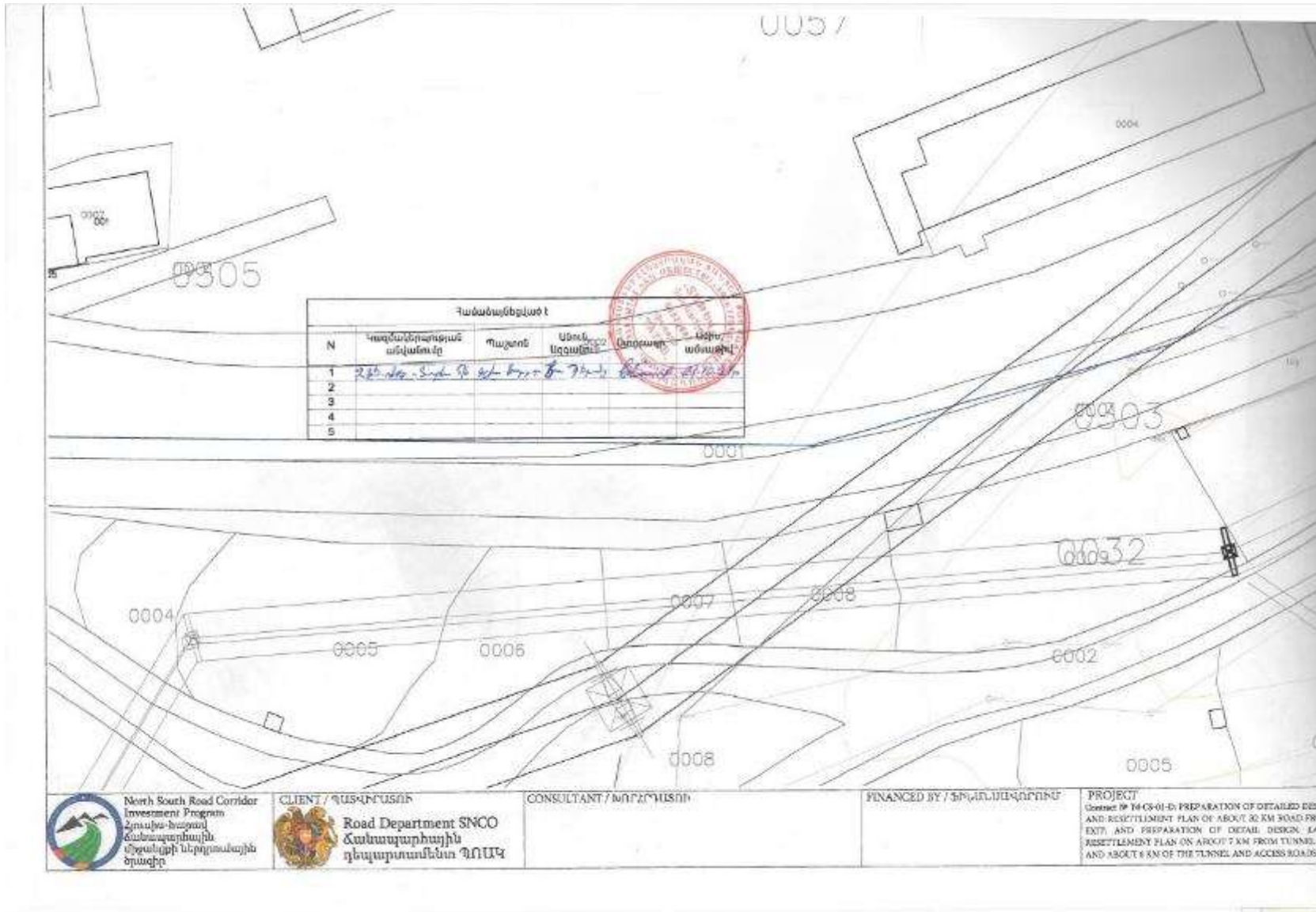


Figure 165

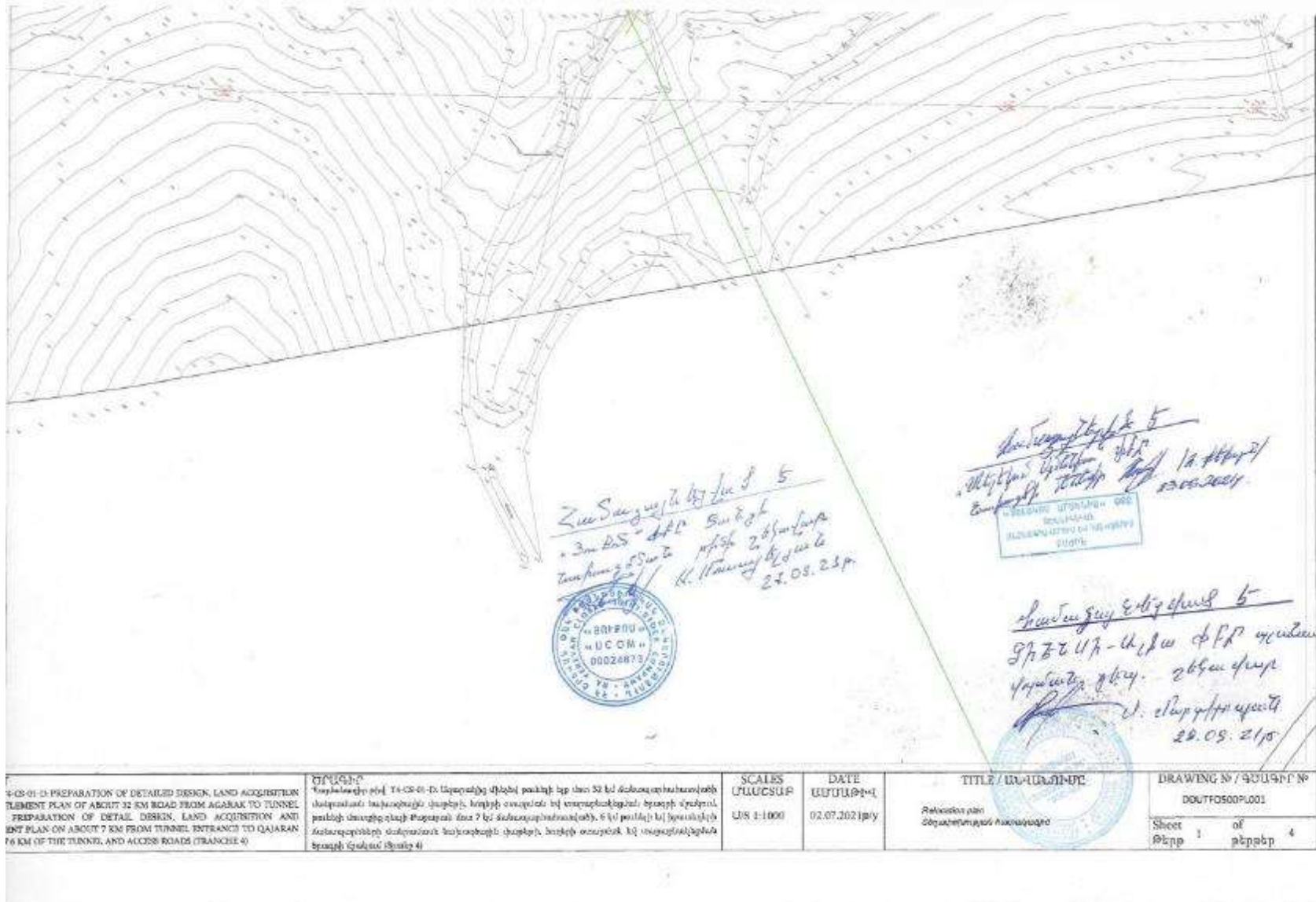


Figure 166

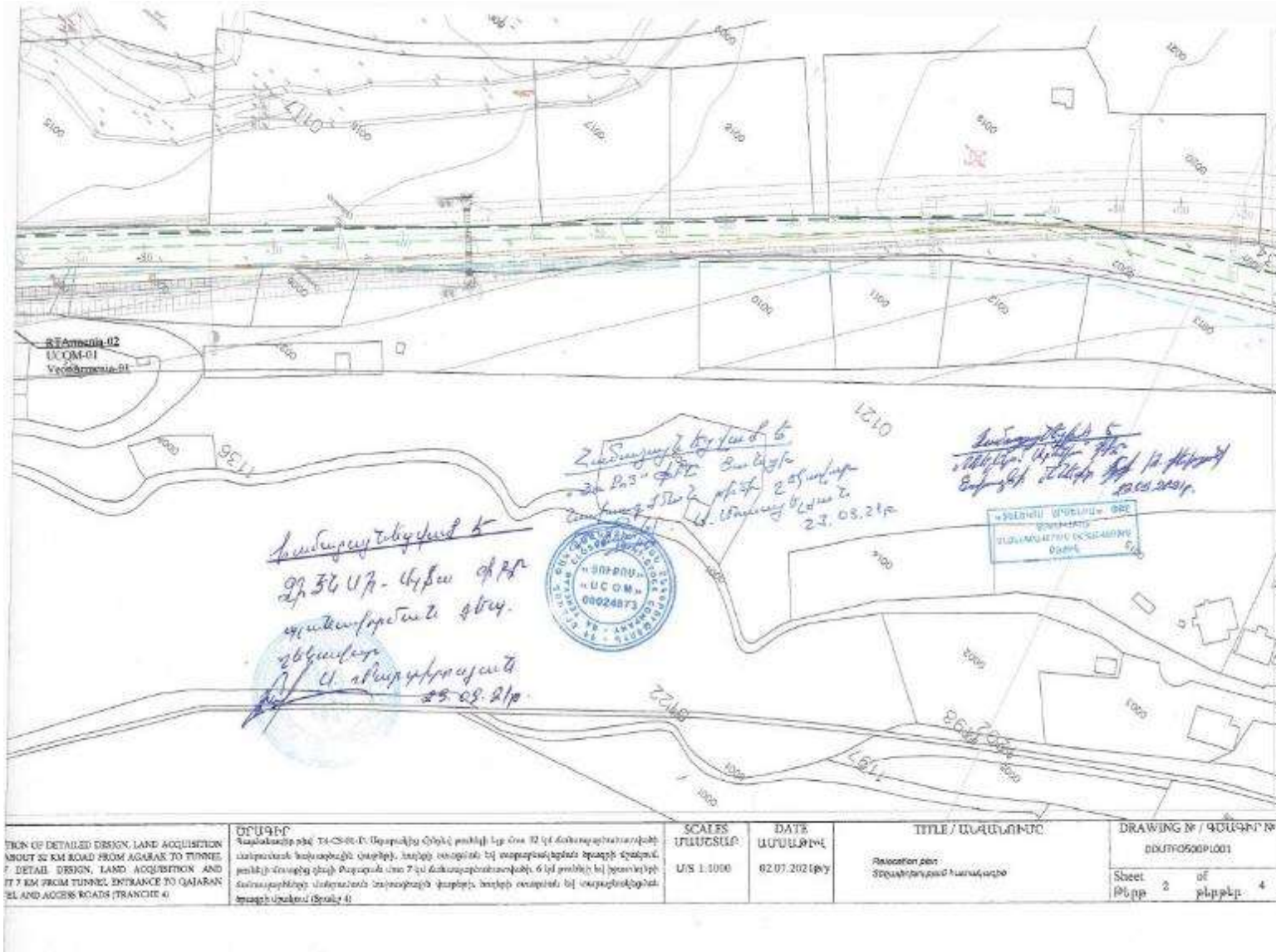


Figure 167



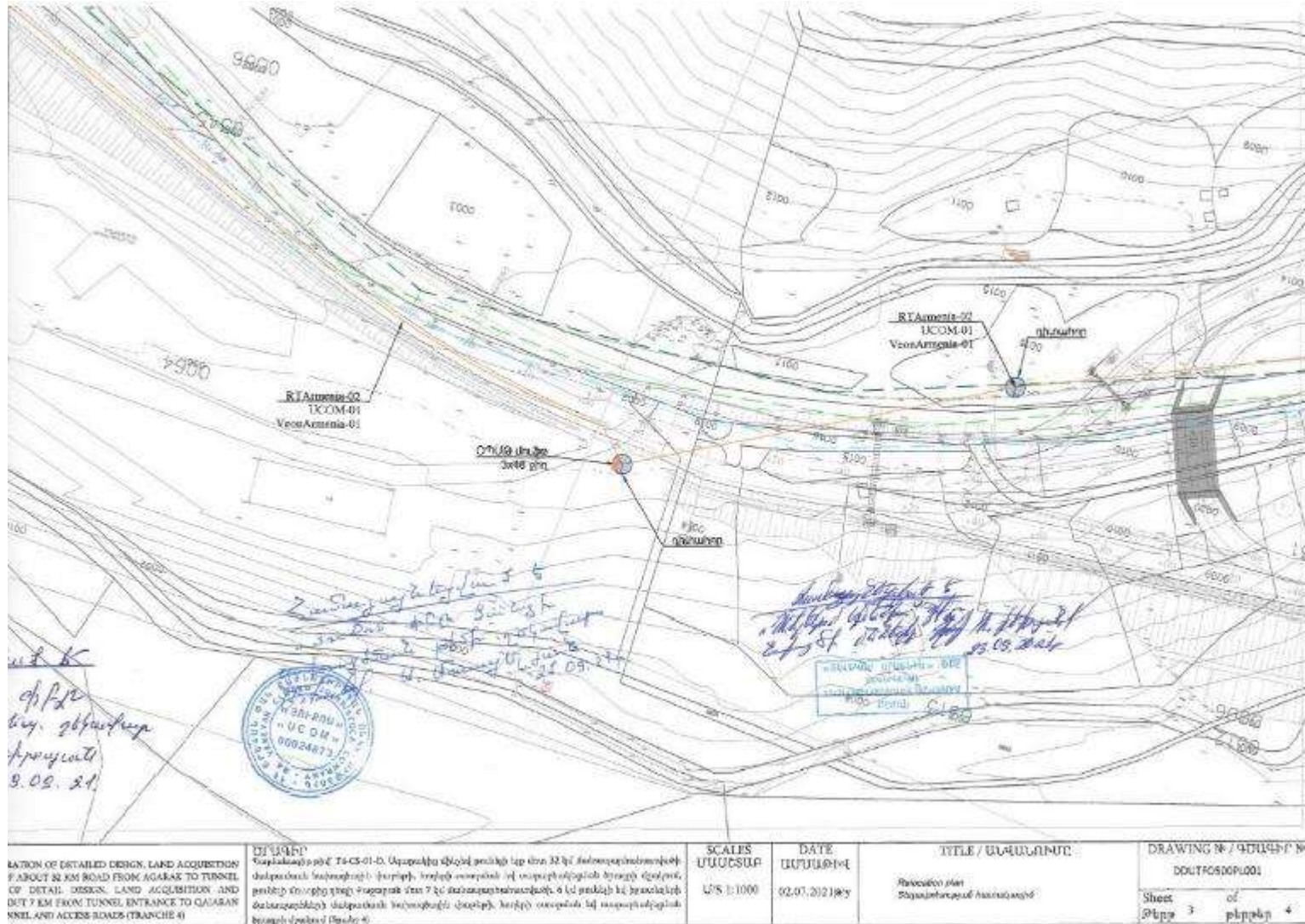


Figure 168





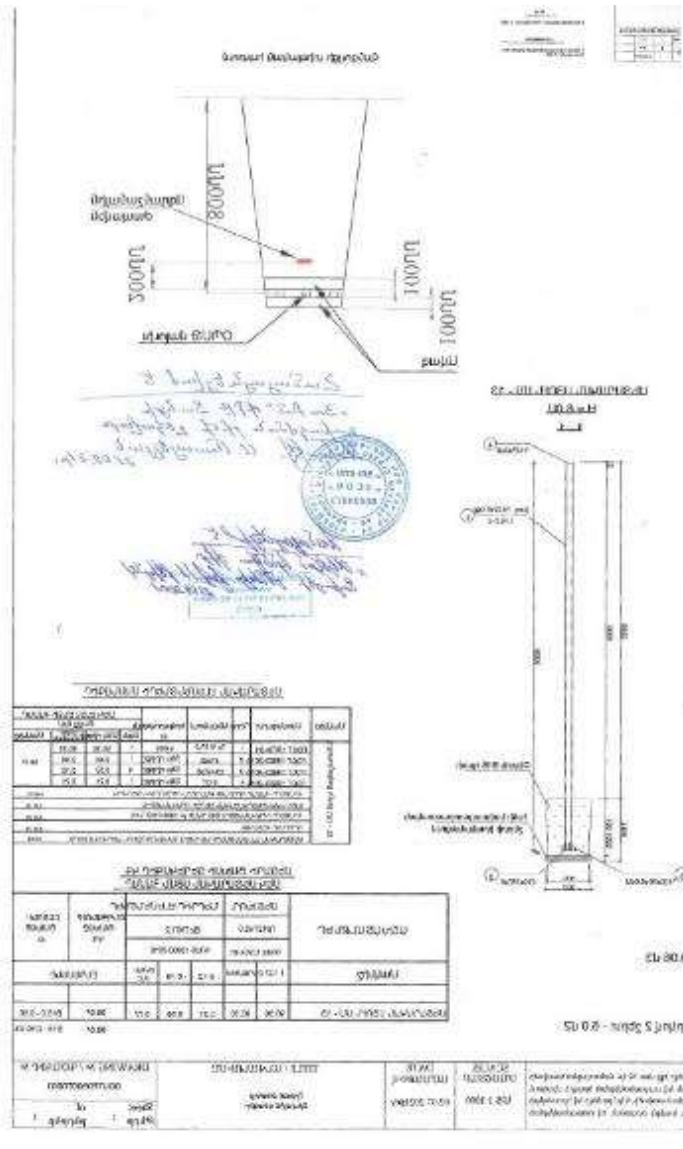


Figure 170



Figure 171







Figure 173

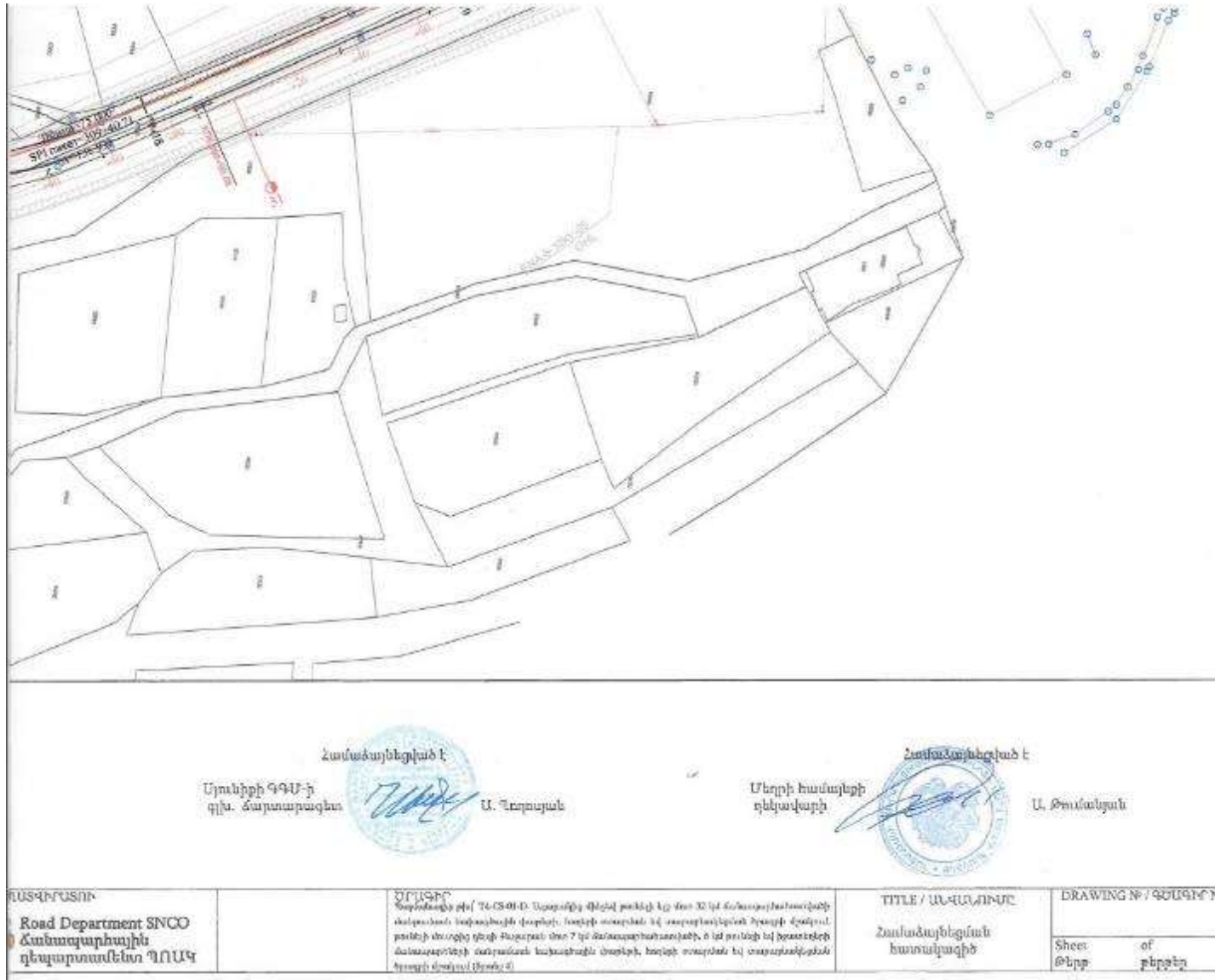


Figure 174

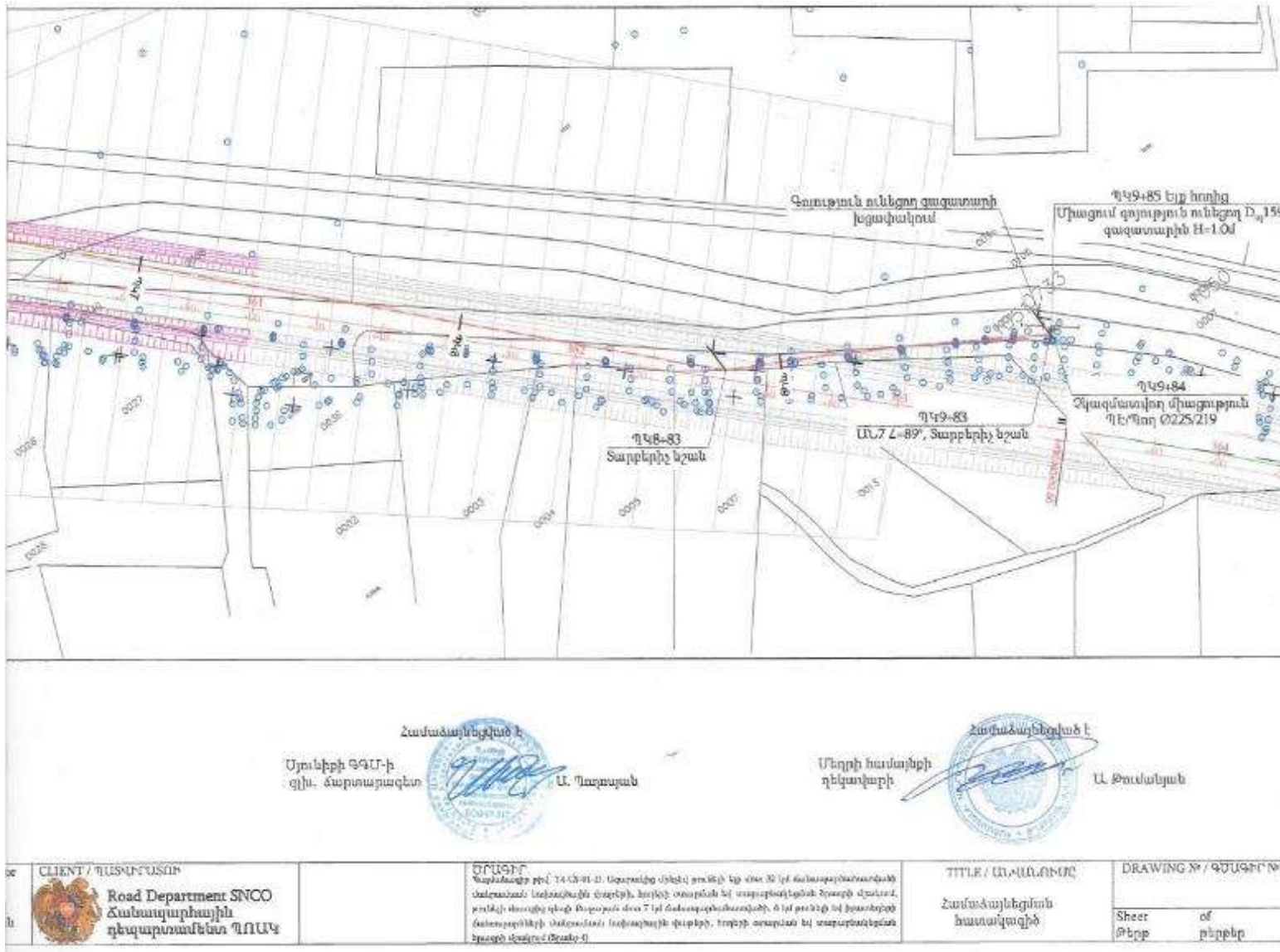


Figure 175





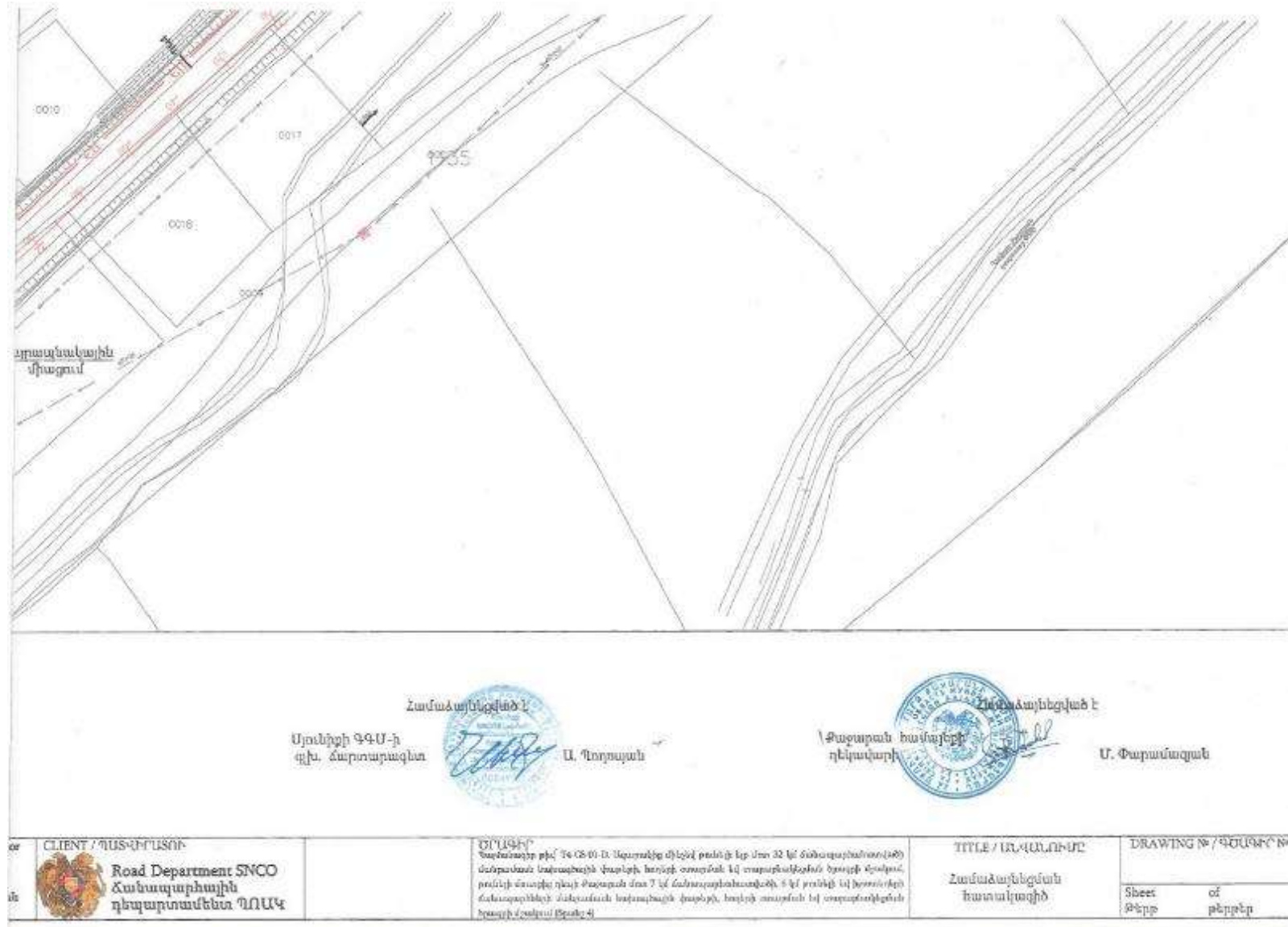


Figure 177



## 12. LAND ALIENATION AND RESETTLEMENT PLAN PHASES AND PRINCIPLES

### 1. Current phases of the procedure on land alienation and resettlement

- Following the preparation of the land alienation and resettlement plan, the alienation and compensation phase (LARP implementation) will start. The construction works will start upon completion of this phase. They cannot start until the impacted land alienation is implemented and the amount of their owners' compensation is paid.
- LARP is prepared by combining the project, cadastral maps and studies conducted in the past, which provide information about the impacted communities, land lots, and constructions.
- LARP preparation presupposes the following phases:
  - 1) Recognizing the land lots subject to impact as public overriding interest.
  - 2) Public discussions within the communities
  - 3) Detailed measurements
  - 4) Registration of the impacted property, including the trees and agricultural crops
  - 5) Census and socio-economic study
  - 6) Development and signing of description protocols
  - 7) Evaluation of property subjected to impact by defining the compensation amount
  - 8) Approval of a final LARP by the RA government and the donor organization
- Implementation of a final LARP:
  - a. Notification to persons subjected to the impact about the preliminary version of the contract
  - b. Preparation of the final contract and signing with the persons subjected to impact
  - c. Resolving issues related to inheritance and owners' absence from the country
  - d. State registration of the alienated property and a part of the property

### 2. Compensation principles and approaches

Within the framework of the project, "The Land Alienation and Resettlement Scope" (LARS) is prepared and approved by the decision of the government, defining compensation implementation approaches. This decision was also approved by the Eurasian Development Bank and it was developed on the basis of the combination of the principles of the Asian Development Bank and our laws. In this regard, comparing similar projects implemented in RA with no international funding, the approaches are quite favorable for the impacted parties.

### 3. Compensation mechanisms

- Real estate property (lands). both for agricultural and non-agricultural lands, persons whose names are mentioned in the certificate for ownership of rights, shall receive compensation in the amount of the market (which is higher) or cadastral value, plus 15%. Usually, the market value is higher than the cadastral one. The market value is defined based on the values of the transactions carried out in the community during the past one or two years. The sold lands are compared to the alienated land lot and the price is defined based on the values of similar land lots. If no transactions have been registered in that community, the transactions made in the neighboring community are taken into consideration.



Different land lots within the same community may have different prices. The price depends on the type of the land, such as, arable land, pasture, and orchard, etc.; it depends on the soil slope, being located on the first or second line, the degree of its stoniness, etc. Respectively, there is no generalized value for the project and the community. The compensation value calculation is the same both for agricultural and non-agricultural lands.

- If there are any leaseholders, that is, persons who have a lease contracts - land ownership right and a respective certificate from the cadaster, the leaseholder will also receive compensation. In that case, the tenant will receive a compensation in the “market value, plus 15%”, depending on the end of the term of the lease contract. If up to one year is left towards the completion of the term of the lease contract, the leaseholder’s compensation will be 5% of the total compensation. In the case of having a contract term ending in up to 15 years, the compensation will be 14%, and for contracts ending in 25 years, the compensation will be 20%, and 25% for 25 years and more.
  - **Owners subject to legitimization:** this group includes persons who received land lots during land allocations, however, they failed to prepare the documents certifying their ownership and to get a certificate from the cadaster committee. Only after registering the ownership in the cadaster and receiving the certificate from the cadaster will those persons be able to receive the calculated compensation.
4. **Buildings and constructions:** approaches vary depending on residential and non-residential buildings. In the case of residential buildings, regardless of the status or the fact of being registered, the owner should receive the value of the substitution, plus 15% as compensation. In order to define the compensation amount, the amount the citizen will need for building a similar construction is calculated. The calculation includes the cost of the construction materials, working labor, design, etc. However, the deterioration of the constructions is not taken out from the compensation cost, meaning, if there are any old wooden windows on the buildings, the price of installing new wooden windows is calculated. And if the building does not have windows the compensation cost will not include a cost for installing windows. Regardless of the compensation, the owner also reserves the right to move all types of materials or construction materials from the building within a certain period of time upon signing the contract on alienation.
- The calculation of the compensation cost is the same for residential and non-residential buildings. Nevertheless, unlike the residential buildings, illegal non-residential buildings should not be compensated. If there are such buildings, the owner should start their legitimizing process, in order to be eligible for receiving compensation. The legitimizing function should be conducted within a certain period of time, after which no compensation shall be provided for legalizing the buildings. In order to get support on this item, the owners may contact the SNCO.
5. **The resettlers** will also receive resettlement aid, as well as financial aid for the impact posed upon them from resettlement and the transfer of private property.
6. **Compensation for agricultural crops:** here the logic of resettlement cost is also used, which means that the citizen gets sufficient amount to be able to create the same. The compensation of agricultural harvest will be calculated with the value/cost of the expected harvest with market values. The quantity and type of agricultural crops subject to alienation, will be described in the property description protocol.
7. **Compensation for trees:** the loss of trees is calculated differently for different trees. Three types of trees have been defined – fruit trees, decorative trees, and trees producing timber. The fruit trees, in turn, are distinguished between young – not bearing fruit yet, and the ones bearing fruit. The compensation for young trees will be done with the equivalent market price/value. Meanwhile, in the case of fruitless trees, the calculation includes the young tree value and the investments which are going to be made on that tree throughout several years – watering, fertilization, etc. For fruitful trees, the compensation amount is calculated as follows: the amount of the possible harvest of the tree for one year is multiplied by the



number of the years, which are required for reaching the fruitfulness age for the tree. For instance, if an apple tree starts giving a harvest in five years after its planting, and the citizen already has a fruit bearing apple tree, the possible annual harvest will be calculated and multiplied by five years, during which the newly planted tree has not given harvest yet. Decorative trees are going to be evaluated with their market value. The trees producing timber will be evaluated with the count of the timber volume, by using a special methodology.

8. **Compensation for an entrepreneurship activity:** there are two types of impact on entrepreneurship activity – permanent and temporary. In the case of permanent impact the property is fully alienated and the possibility to run the same entrepreneurship activity, does not become available. In the case of a temporary impact, for example, the entrance may get blocked, or a certain part of the construction or one of the constructions may be affected, the months of the impact duration, as well as the months necessary for their restrictions will be counted. In the case of a permanent entrepreneurship activity, provided it is legitimate and has a tax declaration, the income received during the past year is calculated in accordance with the tax declarations, and the respective calculated income amount is compensated. If the entrepreneurship activity is not legitimate and not registered, the compensation will be calculated in the amount of the minimal income multiplied by twelve. In the case of both temporary and permanent loss the employees hired for entrepreneurship activities will also receive compensation. In the case of a permanent impact, the average salary of an employee will be calculated for one year and it will be compensated for six months in a way so that the employee has sufficient time to find a new job.

9. **Additional support:**

- Aside from the main compensation amount, in certain cases the project provides additional aid. In the first case the support is provided in the event of an impact of extreme degree, which happens under two circumstances: 1) the aid is provided in the case of a big loss of agricultural income, when more than 10% of the household income is affected from the alienation of the land. In this case, the value of a harvest estimated for one year is calculated and paid. This is paid in addition, regardless of the compensation for trees and agricultural crops. 2) when a move from the residential building takes place. In this case an amount equal to the minimal salary multiplied by six is paid.
- Families moving from residential areas will also receive resettlement aid, which will include one-time survival and transportation costs.
- The vulnerable households will also receive an aid in the amount of the minimal salary multiplied by six. The three types of households are considered as vulnerable, which are poor households and the ones who are stakeholders of “Paros” system. If there are any households that comply with the requirements of “Paros” system, however, they are not registered in the system yet due to certain circumstances, they can be listed by presenting their registration documents to the program and receive additional income. The second group of households is led by single mothers and the third one - by single pensioners.





## 13. LINKS

- ▶ Armecommonitoring (Environmental Impact Monitoring Center): <http://www.armmonitoring.am/>
- ▶ RA Ministry of Environment` <http://www.mnp.am>
- ▶ State Committee on Urban Development under the Government of the Republic of Armenia: <http://www.minurban.am>
- ▶ Ministry of Territorial Administration and Infrastructure of the Republic of Armenia: <http://www.mtad.am>
- ▶ Public Services Regulatory Commission of the Republic of Armenia: <http://www.psrc.am/am/sectors/electric/license-companies>
- ▶ National Atlas of the Republic of Armenia, vol. 1: 2007
- ▶ RA Regions and city of Yerevan: 2015
- ▶ National Statistical Service of the Republic of Armenia: <http://www.armstat.am>
- ▶ Official website of Syunik region: <http://syunik.mtaes.am/>
- ▶ Zangezur Biosphere Complex` <http://www.zangezurkh.am>
- ▶ Website of Zangezur Copper and Molybdenum Combine: <http://www.zcmc.am/eng/>
- ▶ Summary of the Southern Basin Management Organization, 2016
- ▶ Feasibility Study of the southern section of the North-South Road Corridor Investment Program, the section of Kajaran-Agarak, 2014
- ▶ Safeguard Policy Statement, ADB. 2009
- ▶ National Action Plan on Combating Desertification in Armenia, 2002



**ANNEX 19: STATE EXPERTISE CONCLUSION**

I approve  
Minister of Environment  
H. Simidyan

15.02.2022

**STATE EXPERTISE CONCLUSION**  
**ENVIRONMENTAL IMPACT ASSESSMENT EXPERTISE**

ԲՏ 0010-22

Entrepreneur: IRD Engineering S.r.l.  
Yerevan, 0025, Khanjyan 50

Activitie: About 32 km road from Agarak to tunnel exit; and about 7 km from tunnel entrance to Kajaran and about 6 km of the tunnel and access roads”, which was presented for environmental expertise of environmental impact assessment  
Syunk region

Acting Director of Environmental Impact  
Assessment Center SNCO:

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Attachement: 13 sheets

## STATE EXPERTISE CONCLUSION

### ENVIRONMENTAL IMPACT ASSESSMENT EXPERTISE

ԲՏ 0010-22

15.02.2022

**About 32 km road from Agarak to tunnel exit; and about 7 km from tunnel entrance to Kajaran and about 6 km of the tunnel and access roads”, which was presented for environmental expertise of environmental impact assessment**

Entrepreneur: IRD Engineering S.r.l.

Document type: Environmental Impact Assessment /EIA/

Activity type: A category

Location: Administrative areas of Syunik region, Lernadzor, Kajaran, Tashtun, Lichk, Lehvaz, Vardanidzor, Gudmnis, Meghri and Karchevan settlements

**Introduction:** “North-South Road Corridor Investment Program” is a major infrastructure project (NSRCIP project) which aims at connecting the Southern border of the Country with its Northern point by means of 556 km-long Meghri-Yerevan-Bavra highway by reducing it about 85 km and reaching up 470 km. Tranche 4 is the southern part of the North-South corridor, which consists of 3 main sections and 8 subsections. It begins from the town of Artashat and ends at the mutual border between the Republic of Armenia and the Islamic Republic of Iran. In Tranche 4, the section Kajaran-Agarak (section of M2 road from km 328+600 to km 384+000) is the most South one going from Kajaran to the Iranian Border.

The Republic of Armenia and the Eurasian Development Bank (EDB) out of Eurasian Fund for Stabilization and Development signed Loan Agreement to implement Tranche 4: Kajaran-Agarak road section. “Road Department” SNCO was appointed as the Project Implementation Unit (PIU) acting under the Agency Agreement signed with the Ministry of Territorial Administration and Infrastructure of Republic of Armenia.

**Description:** In general, the proposed 42,300 m long Kajaran-Agarak road (Tranche 4, Precinct 1 and Precinct 2) will pass through nine (9) settlements, which are: Lernadzor, Kajaran, Tashtun, Lichk, Lehvaz, Vardanidzor,



Gudemnis, Meghri and Karchevan, from which only 6.95 km must pass through a tunnel, from Pk 3.5 to Pk 10.45 within the borders of Lernadzor, Kajaran and Tashtun communities.

The section of Kajaran-Vardanidzor of the North-South highway starts from the administrative area of the village of Lernadzor, passing through the route of M2 interstate highway. From the village of Lernadzor it enters a tunnel of approximately 7,2 length, going through the maintain pass of Tashtun (2483 m) and getting to the forest-lined gorge of river Tashtun. Prior to reaching Vardanidzor, the routs of the envisaged project mostly goes through the route of the current road. In some cases, the constructed highway reaches forested areas, bypassing the residential areas, which will appear in the impact zone during the project implementation. The route of the envisaged project passes through different sections of rivers Tashtun and Meghri, the gorges of which have quite complicated relieves, the steepness of the slopes often exceed 30 degrees, and the forests mostly have a protection significance.

In the EIA three alternatives of the road plan were proposed and in all of them are potentially adverse effects on protected areas, forests, historical and cultural sites, archaeologically sensitive sites and alientation and ressetelmet are unavoidable. As a result of the comparative analysis of alternatives, environmental, social and cultural factors were taken into account when choosing the preferred option.

The designed 45 km road section is the continuation of Sisian-Kajaran 60km road section. The propsed design includes the detailed design package of M2, Kajaran-Agarak (from 328+600 km to 384+000 km) road section. The construction works will be carried out on a 32 km road section, about 21 km from Agarak to Vardanidzor (5 km widening of the existing road + 16 km new road), about 11 km from the tunnel exit from Vardanidzor. The Kajaran-Agarak road section is mainly located in the gorge.

The total length of the The Tranche 4, Kajaran-Agarak road section is approximately 45 km road, from which:

- about 21 km road from Agarak to Vardanidzor
- about 11 km road from Vardanidzor to tunnel exit (Lot 1)
- about 7 km road from tunnel entrance to Kajaran
- about 6 km of the tunnel and access roads (Lot 2).

The road is foreseen with asphalt-concrete pavement (as per proposed design), with design speed 100km/h, which consists of upgrading and widening existing 2-lane road (km379+000 – km384+000, about 5km) and construction of completely new 2 lane single carriageway with bridges and tunnels. Works include design of connections (or interchanges) of new road with existing M2 road, communities and businesses if necessary. The new road section alignment will be designed and constructed to standards that will result in improved road markings, signage, tunnels, bridges, drainage, culverts, overpasses, underpasses, and shoulders.

As per design there will be a total of 14 bridges, 3 tunnels and 27 culverts:

1. (From km 3+700 to km 10+600, 6975m);
2. (From km 16+300 to km 16+700, 400m);
3. (From km 34+900 to km 35+300, 420m).

The works also include the survey and investigations of all existing infrastructures which are faced with new





designed road.

Relocation of Utilities including:

- Drinking water pipelines
- Irrigation channels/pipelines
- Gas Pipelines
- Electricity power lines

It is expected that construction will be undertaken over a period of 5 years. Due to rocky terrain, grassing of the embankments is not envisaged. Excess soil generated and removed rocks during construction will be classified in accordance with the RA legislative requirements and will be placed in the area provided by the community leaders and in the future will be used for the purpose.

The territory has a steep relief, moreover, the lowest point is 375 m, which is located in the valley of the Araks river, and the highest point is 3904 m (mount Kaputjugh peak) (the highest points are Kaputjugh, Sisakatar and Gazanaler). Possible earthquake magnitude in the described area is 6-8 points, the maximum horizontal accelerations being 0,3-0,5g (data obtained from the National Seismic Protection Service).

The region is characterized by a dissected, structural erosion-relief type: moderate steep, soft, partially rocky slopes, weak wavy watershed, with folding structures of intraocular and balloon rocks, with stair cataracts.

The route of the highway, as envisaged by the project, nearly entirely (except the tunnel section) passes first along the valley of river Voghji, and then Meghri river, with numerous fords. There are no lakes and ponds in the requested area, however, rivers Voghji and Meghri, along with their tributaries flowing down the area, the banks of which are abundant in mesophile vegetation; there are also superhumid sections. It intersects with ecological systems in 1920 m. above sea level up to 540 m above sea level will have direct and indirect effects on the physical and biological resources of the environment. Prior to the preparation of the EIA report, field surveys were conducted to identify risks and develop appropriate measures.

Different types of *natural landscapes* can be found in the studied areas:

- a) Roads with two-side or one-side individual trees and shrubs,
- b) Forest-lined hillsides, often times with great steepness,
- c) Rocky forest-lined and shrub-lined hillsides,
- d) Cultivated and non-cultivated orchards,
- e) Rivers, fords,
- f) River valleys, covered with shrubs, individual trees or groups of trees,
- g) Dry hillsides covered with dry shrubs, etc.

The Kajaran-Agarak road section impact zone includes the southern parts of the floristic area of Zangezur and certain areas of Meghri's floristic region. The following vegetation types can be found:



- Deciduous forests (Quercus-Carpinus, Carpinus-Quercus, Quercus-Carpinus-Acer and other coexistences and riverbed forests)
- Sparse forests (deciduous sparse forests, mixed sparse forests, coniferous sparse forests (Juniperus))
- Shibliak
- Drought-tolerant mountain – phrygian (mountain-xerophile) vegetation (tragacanth shrubs, mountain xerophyte scrubs)
- Semi-deserts

In the requested area, the forests are mostly distributed on highly steeped slopes (30% and more). Forest coexistences with prevalence of Quercus and Carpinus are mostly common. A broad-leaved forest with prevalence of Quercus can be found in the section bypassing the village of Lernadzor and the first tunnel exit, on the right bank hillsides of river Meghri. A deciduous forest with prevalence of Carpinus can be found on the right-side hills of the canyon of the river of Gozgoz, up to the section of the second tunnel entrance. The types of trees and shrubs affected as a result of the construction of the road section, as well as their number were found out during the field studies /the calculation was made taking into account the peculiarities of the landscape/. According to the study, more than 19,000 (19,366) trees will be cut down during the construction works. More than 180,000 (185,659) bushes will be cut down after clearing and cutting the bushes. If possible, the removed trees are planned to be replanted in late autumn, after the leaf fall or early spring. Cutted / damaged shrub vegetation should be restored in a ratio of 1: 2 (except for Red Book species, which should be restored in a ratio of 1:10). New trees should be cared for for 3 years before they become viable (80% survival is considered excellent). Detailed information about cutting trees and bushes is provided in Appendix 8.

The section of Vardanidzor-Agarak of the North-South highway is located on a 540-100 m.a.s.l. From the upward landscape zones, it partially includes dry steppe low mountainous (1000-1600 m.a.s.l.) and semi-desert mountainous (500-1000 m.a.s.l.) zones.

The total number of plant species along the proposed project was studied by a suitably qualified botanist to determine the types of affected flora. It is expected that the construction of the tunnel will have a great impact on the flora and loss of vegetation, in particular, at the exit of the tunnel to the city of Meghri / which is included in the territory of "Arlik" National Park /, as well as construction of an overpass road near it. The detailed description of flora, as well as a number of plant species, which are considered endangered and have been registered in the Red Book of Plants of Armenia, and can be found adjacent to the study areas, are presented in Annex 6. According to the Red Book for Flora (Governmental decree 29.01.2010, N 72-N), 17 plant species from 55 Red Book listed species will be directly affected and measures to protect each of them are presented in the EIA report. A qualified botanist will be hired to transport the affected species. If it is not possible to transplant the plant (perennial trees, tall shrubs), it is necessary to collect seeds to get planting material in one of the local nurseries for further planting. More detailed information is provided in the EMP and Appendix 8.

Special attention needs to be drawn on the species presently preserved in the area, as prescribed by the RA law "On Fauna" (2000) and the requirements of the Red Book of RA Animals (Decision of the RA Government N71-N, dated January 29, 2010). The special mitigating measures were included in the EMP to bring the adverse effect on the fauna to the minimal and to avoid posing the species registered in the Red Book to adverse effect. During the construction, the mammals, reptiles and amphibians gathering in large groups near the construction area, need to be collected and taken to more convenient and safer locations. The collection of animal species should be done prior to starting using heavy construction equipment. In the case of discovering inhabited nests, they need to be moved out under the supervision of a respective specialist prior to the start of the construction



works. During field visits, possible destinations of migration routes have been investigated. As the studies have shown, there are no animal migration routes along the entire road. The installment of the envisaged water drainage system (water intake, rectangular pipes) will serve as a transition for animals.

The projected road section passes mainly near "Arevk" National Park, but some sections /in Meghri region/ touch the territory of "Zangezur" Biosphere Reserve ("Arevk" National Park) in the following sections:

- Part 1 - widening of the current M2 road from the planned tunnel exit to about 2.5 km
- Part 2 - Vank-Kaler intersection, about 1.2 km
- Other parts (3 sections) - about 100-250 m

During the preparation of EIA report, the specialists/ zoologists, botanists, archeologists and representatives of "Zangezur" Biosphere Reserve SNCO/ have carried out detailed studies to identify possible negative impacts on the "Zangezur" Biosphere Reserve, as well as to identify the risks /Annex 13/. The research did not reveal any serious risks, and the general measures to mitigate the impact on specially protected areas are presented in the EMP. For specially protected and sensitive areas, a monitoring and management plan should be developed by the Contractor.

The detailed research revealed that none of the natural monuments In Syunik region approved by Decree N-967 of Government of RA on 14.08.2008 will be affected during the implementation of the Project, as they are located pretty far from Project implementation area.

As a result of the fieldwork, 19 monuments were documented along the entire length of the project, 14 of which are in the area of direct impact of the project. During the preparation of the project, the historical and cultural monuments that have a possible impact have been studied in detail, the results are presented in Annex 9 and appropriate solutions have been presented for their preservation.

The expected impacts of the project on the biophysical environment (such as soil erosion, increased noise and vibration levels, air and water quality) are likely to be temporary, occurring only during construction. These impacts are manageable; it will be possible to reduce or eliminate them altogether by implementing the mitigation measures proposed in the Environmental Management Plan in a timely manner. Environmental protection, public safety, safety of workers and employee hygiene at all stages of the project will be in full compliance with the legislation of the Republic of Armenia requirements, as well as of international funding and consulting organizations.

Contamination of water is possible during construction of 14 bridges in valleys, streams, and rivers as well as during construction of 3 tunnels. The potential impacts are associated with the accidental oil or grease spills, disposal of excavated earth, lefted excess construction material after construction works, which may be washed into the water sources and lead to sedimentation of water sources and lowering of the water quality.

The following measures shall be taken into account to mitigate/restrict the impact on water quality:

- River beds and drainages in and around the construction site will be maintained in good condition and no excavation material or other particles originated by works will fall in them.
- Bridge construction activities including pile driving will be undertaken during summer and winter when water level is low in rivers or during dry periods for seasonal streams.
- Oil leaking equipment and machinery shall be forbidden to operate.



- All chemicals and oil will be stored away from water bodies.
- On construction site fuelling area of vehicles and equipment will be selected away from valleys, streams and rivers.
- Oil/ water separators to extract floating oils will be installed at the fuelling areas.
- Application of erosion control practices to prevent excessive onsite damage.
- No vehicle or equipment will be washed, parked or refuelled near valleys, streams and rivers.
- All construction camps will be located at least 1km from rivers and to the extent possible labourers will be locally recruited to avoid large camps.
- Storm water collected on bridges will flow through an oil separator beneath the bridges to retain any pollutant from the road to run off directly into rivers,
- Adequate drainage structures will be provided to facilitate natural flow of water across road embankment.
- The Emergency Response Plan shall be prepared and approved involving action plan for hazardous spills treatment.

Special Mitigation measures for the tunnels will include:

- Installation of a water proofing system between the initial ground support system and the final concrete lining. This will consist of a PVC membrane with protection layers made from geo-textile material;
- Collection of roadway water in a dedicated drainage system to separate it out from the clean water drainage system. As the tunnel will be open for vehicular traffic, the drainage system will consist of a slotted gutter. This will be connected to the principal longitudinal drains by gully pits containing a siphon system.
- Water collection basins will be put at each end of the portals where drainage water will be collected and settled before being discharged into natural watercourses,

Tunnel excavation will require extraction of geological resources consisting of sedimentaries and the blasting operations will lead to rock movement, minor fragmentations and vibrations. Appropriate blasting design will be adopted which will consider safety.

Prior to the construction, the lands and buildings located in the alienation zone should be alienated and demolished. A generic social impact assessment will be conducted and Soil alienation and resettlement program will be developed. The soil alienation will be carried out in accordance with SARP (SARP general description and principles are briefly presented in Annex 9).

| Significance                                                           | Quantity m <sup>2</sup> |
|------------------------------------------------------------------------|-------------------------|
| Forest                                                                 | 173,971.00              |
| Industrial, earth interior and of other related significance           | 18,159.00               |
| Residential                                                            | 300,526.00              |
| Agricultural                                                           | 1,299,832.00            |
| Energy, transportation, communication, communal infrastructure objects | 139,191.00              |
| Specially protected areas                                              | 34,597.00               |
| Water                                                                  | 44,271.00               |





Communities near to the road construction activities will experience temporary inconveniences related to construction, including noise, dust, and bypasses.

The main impacts include dust generation, fumes from the hot mix plants, crushers, vehicles and from the transportation of all types of construction material. Fugitive dust generation due to operations such as excavation of construction materials in borrow and quarry areas, loading, transportation and unloading of construction materials, cutting and drilling of rock masses and dust due to other construction activities. Fugitive dust released during above activity may cause immediate effect on construction workers, inhabitant around the road alignment especially those residing in downward wind direction. Concrete and asphalt batching plants as well as stone crushing machineries are required to be located at least 1 km away from the nearest sensitive receptor (e.g., communities, protected areas). Watering should be provided on road surfaces, extraction and construction sites to keep them moist and control dust. Trucks carrying dirt, sand or stones should be covered. Emission control devices will be installed to ensure regular monitoring of construction camps and settlements near road construction /as defined in the Monitoring Plan/.

Total duration of the construction works will be 5 years, the construction equipment and trucks will work 50 months. The main emissions during the construction works occur during the earthworks, operation of construction equipment and vehicles and as a result of asphaltting works.

The total emissions are presented in the table below:

Emmissions of construction works

| <i>N</i> | <i>Adverse substance</i>                     | <i>Amount of emissions caused by the construction, t</i> |
|----------|----------------------------------------------|----------------------------------------------------------|
| 1        | Inorganic dust                               | 1150                                                     |
| 2        | Carbon monoxide                              | 880                                                      |
| 3        | Carbohydrates                                | 203.35                                                   |
| 4        | Nitric oxides (calculated as nitric dioxide) | 1026.6                                                   |
| 5        | Solid particles                              | 104.06                                                   |
| 6        | Sulfur dioxide                               | 96.8                                                     |

In order to evaluate the impact of emission, a calculation of their dispersion in the atmosphere was conducted and the results were compared to sanitary norms. The calculations made on two conditional platforms are provided below – one for the Kajaran group and one for the Meghri group.

Results of terrestrial concentration calculations:

| <i>N</i> | Pollutants      | Maximum one-time TLV, mg/m <sup>3</sup> | Maximum riverbed concentrations |                   |              |                   |
|----------|-----------------|-----------------------------------------|---------------------------------|-------------------|--------------|-------------------|
|          |                 |                                         | Kajaran group                   |                   | Meghri group |                   |
|          |                 |                                         | On TLV                          | mg/m <sup>3</sup> | On TLV       | mg/m <sup>3</sup> |
| 1        | Inorganic dust  | 0.5                                     | 0.4                             | 0.2               | 0.4          | 0.2               |
| 2        | Carbon monoxide | 5.0                                     | 0.08                            | 0.4               | 0.08         | 0.4               |



|   |                        |      |                            |        |                            |        |
|---|------------------------|------|----------------------------|--------|----------------------------|--------|
| 3 | Carbohydride ranges    | 1.0  | 0.0009                     | 0.0009 | 0.0008                     | 0.0008 |
| 4 | Nitrogen dioxide       | 0.2  | 0.04 (0.05 <sup>10</sup> ) | 0.008  | 0.04 (0.05 <sup>11</sup> ) | 0.008  |
| 5 | Solid particles (soot) | 0.15 | 0.0093                     | 0.0014 | 0.0077                     | 0.0012 |
| 6 | Sulfur anhydride       | 0.5  | 0.04                       | 0.02   | 0.04                       | 0.02   |

The total economic damage calculated for Kajaran-Agarak road section construction will be 426630391 AMD.

During the construction works water is used for the needs of the local water sprinkler, soil mass moisturizing, as well as for the drinking and household needs of the construction staff.

It is considered to operate 7 construction sites simultaneously. The water demand per one site is 1728 m<sup>3</sup>/constr. Water consumption for drinking and household needs of employees will be 62832 m<sup>3</sup>. Water supply will be provided from the community water networks located along the road section, at the expense of community limits.

For the daily needs of the employees (bathrooms, dining rooms, etc.) it is planned to rent areas in the settlements along the road. The areas will be provided with water supply and sewerage systems.

Soil and ground of 6000000 m<sup>3</sup> is dug and removed during the road location and construction site preparations. A part of this extraction - 1200000 m<sup>3</sup> is used as a backfill. The rest - 4800000 m<sup>3</sup> for developing the internal and final formation, as well as for flattening and improving the road. The topsoil layer of the envisaged road construction affected area mostly varies between 15 – 25 cm. The total volume of the topsoil subject to removal is approximately 105000 m<sup>3</sup>. The topsoil will gather in separate locations of specially designated areas of the 5 dumps and in the composition of the dumps to be near the work platforms, and will be used for improving the local area. The location, coordinates, characteristics, and maps are provided in Annex 10.

Trees will be cut down in several areas during the works. The cost of planting trees is included in this report as damage to biodiversity. A total of 19,366 trees are planned to be cut down. According to preliminary calculations, the costs will be: 19366 piece x 2 : 1500 piece x 3.0 million AMD = 77.46 million AMD. It should be noted that the loss of trees from private ownership (and loss of any related business activities) is subject to compensation under Land Acquisition and Resettlement procedures.

The waste generation sources were classified as main /construction/ and auxiliary /transportation and construction equipment service, supply, household service of employees/, which include used motor oil wastes, inhabited tire cover, inhabited lead accumulators and spoilage, unsorted steel containing waste, construction wastes, household wastes etc., for the removal of which appropriate solutions have been presented.

Noise level monitoring program will be implemented by the Contractor and Engineer to ensure compliance to noise standards. Baseline and regular monitoring will be conducted within the construction camps and in community areas close to active road construction fronts, as it will be provided in the Monitoring Plan.

<sup>10</sup> Taking into consideration the feature of compounding with sulfur anhydride

<sup>11</sup> Taking into consideration the feature of compounding with sulfur anhydride



Mitigation measures that will be applied to minimize noise include:

- Siting noise sources away from the communities and sensitive ecosystems, the construction camp including all plants will be located at least 1 kilometer away from the communities;
- Timing of noisy construction activities only between 9:00 to 18:00 to avoid disturbance to nearby communities at night;
- Minimizing the need for heavy vehicles to pass through residential areas by specifying routes along public roads, site access points, and haul routes;
- Installing and maintaining effective exhaust silencing systems on vehicles and equipment;
- Installing temporary soundproofing and sound-absorbing barriers adjacent to tunnels' portals and around noise sources near sensitive sites where other mitigation measures are not sufficient or practicable;
- Providing ear plugs and muffs to all construction workers who are likely to be exposed to elevated noise, ensuring exposure limited to no more than 8 hours at greater than 85 dB.

The Contractor shall obtain all necessary permits for traffic movements and shall prepare a Traffic Management Plan during the mobilization period to set out safe entry and exit points, enforce strict safety on public roads in conjunction with local police forces.

Road warning signs, humps should be installed to minimize speed and reduce accidents. Diversion roads should be made and traffic guides put in place to avoid risk of accidents to the community.

The Contractor must have a Health and Safety plan, as well as trained first aid personnel and emergency response equipment.

By the end of construction phase and prior to handover of the site by the Contractor to the MTAI, the Contractor will reinstate the site which will include clearing the site of all construction-related material and waste. Landscaping activities should include planting native trees and shrubs as will be provided in the EIA report. All removed trees and shrubs that are not from acquired lands will be replaced with native trees and shrubs at a ratio of 1:2. The Contractor shall ensure that any plantations are correctly maintained during the works and defects liability period and will engage competent companies to maintain the trees and shrubs following construction.

The Environmental Management Plan (EMP) /which is an integral part of the final EIA report and will be included in the bidding contract/ sets out mitigation measures that need to be implemented during the Project to avoid, reduce or mitigate adverse environmental impacts. The mitigation measures proposed in the EIA report are presented in 13 sub-plans based on international best practices in environmental management. The EMP includes potential impacts, proposed mitigation measures and responsible authorities for their implementation, as well as monitoring activities and estimated costs. The EMP can be a guide for MTAI and other relevant bodies /including the EMIU/ during construction, operation and maintenance phases.

**Final part:** The construction of this strategically important road will provide easy access from the southern border of Armenia to the Georgian border, then to the Black Sea ports, allowing cargo transportations, passenger



transportations in line with European standards and opportunities for the economic development of the country. The project will provide a link between Agarak and Kajaran regions remote communities and will have a positive impact on the communities in terms of job creation during construction phase.

In the result of Project implemetatio, the current road of 556 km with an average speed of 60 km/h into a 470 km-road with a 100 km/h design speed will decrease travelling time from over 9 hours to just 4.5 hours and will ensure an easier transit and better safety.

Nearby communities will be temporarily exposed to negative impacts during construction phase (dust emissions, noise, inaccessibility of roads, etc.), but they will be short-lived and due to the implementation of the measures envisaged in the EMP, they will be brought to the permissible norms.

In the process of environmental impact assessment and expertise, public awareness and discussions (public discussions in Kajaran and Meghri communities of Syunik regions of RA) were carried out in accordance with the RA legislation, the remarks and suggestions voiced by the public were accepted and were taken into account in the processes of environmental impact and expertise. During the public discussions, questions were raised about the possible effects of blasting works during the construction of the tunnel, the areas for forestry works, the irrigation of trees and the control of the works by the residents of the mentioned works. During the examination process, opinions on the project were received from the RA Ministry of Internal Affairs, Ministry of Health, Ministry of Emergency Situations, MTAI, the Committee of Urban Development, the Cadastre Committee, as well as the subdivisions of the Ministry of Environment, which were also taken into account in the examination process.

## Expertise Requirements

1. Prior to the implementation of the activity, it is necessary to obtain the relevant approvals / permits (including water use, drainage, change of land use, relocation of existing infrastructure, etc.) in accordance with the RA legislation.
2. When carrying out the activity, it is necessary to be guided by the requirements of the RA Law on SPAs and the RA Government Decision N 1465-N of December 19, 2013, the RA Law on Fauna (2000) and the RA Law on Flora (1999)., as well as according to the Decrees No 967-N of 14.08.2008, No 781-N of 31.07.2014 of the Government of RA and according to the requirements of the Decrees No 71-N and No 72-N "On approving the Red Book of Plants and Animals of the Republic of Armenia".
3. Measures to compensate the damage caused to the forest economy of the lands to be alienated in the "Forestry" branches must be implemented in accordance with the requirements of the RA Government Decision No 1045-N of August 30, 2007.
4. During the construction of the tunnel, it is necessary to provide technical safety measures to assess the technical condition of the structures adjacent to the tunnel etc. in order to prevent the possible impact of blasting works on residential buildings.





5. According to point 43 of the Decision of the Government of the Republic of Armenia No 438 of April 20 "Institutions, legal entities and individuals are obliged to stop the work from the moment of discovery of archeological or other objects of historical, scientific, artistic and other cultural value, and to inform the authorized body about it immediately."
6. The tasks and methods of preservation of historical and cultural monuments affected along the water line (study, excavation, route relocation, consideration of alternatives) must be carried out in accordance with the functions and procedures of the RA Ministry of Culture.
7. Identify the location of construction sites, temporary storage of vegetation, areas for removal of wastes, construction wastes and envisage them based on the relevant agreements given by the leaders of the affected communities /Kajaran, Meghri/.
8. Carry out the cutting, storage, preservation, further use or sale of topsoil according with the requirements of the Decrees No 1404-N of November 2, 2011 No 1396-N of September 8 by the Government of RA, as well as in accordance with the requirements of the Decision No 676-N on defining the order of sale of the topsoil removed as a result of the construction works.
9. The composition of the trees and shrubs to be planted and the planting works should be carried out in accordance with the RA legislative requirements for afforestation works agreed with the heads of Kajaran and Meghri communities and with the the Ministry of Environment /maintaining 3-5 years of care and ensuring stickiness/, to develop projects for afforestation works in accordance with the RA legislative requirements and to coordinate them with the state authorized body.
10. During the construction, it is necessary to ensure the implementation of the monitoring activities and monitoring observations of the measures proposed in the environmental monitoring plan and EMP, the results of which should be available to the interested state bodies and to the public.

## Conclusion

A positive conclusion is given on the environmental impact assessment report of the "North-South Road Corridor Investment Program", Tranche 4: about 32 km road from Agarak to tunnel exit, about 7 km from tunnel entrance to Kajaran and about 6 km of the tunnel and access roads project package, subject to the mandatory fulfillment of the above requirements.

Chief Specialist of Environmental Impact

Assessment and Expertise SNCO \_\_\_\_\_ H. Mkrtchyan

Total: 13sheets



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Շրջակա միջավայրի նախարար  
Հ. Սիմիոյան



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**Ձեռնարկողը՝** «ԱՅԵՌԴԻ ԷՆՋԻՆԻՐԻՆԳ» ՍՊԸ  
*Երևան, 0025, Խանջյան 50*

**Գործունեությունը՝** Ազարակից թունելի ելք մոտ 32 կմ ճանապարհահատվածի, թունելի մուտքից դեպի Քաջարան մոտ 7 կմ ճանապարհահատվածի, 6 կմ թունելի և իջատեղերի ճանապարհների նախագծային փաթեթի շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն  
*Սյունիքի մարզ*

«Շրջակա միջավայրի վրա ազդեցության փորձաքննական կենտրոն» ՊՈԱԿ-ի տնօրենի պարտականությունները կատարող՝



Խ. Մարտիրոսյան

Առդիր՝ 13 թերթ



ՊԵՏԱԿԱՆ ՓՈՐՁԱՔՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ  
ՇՐՋԱԿԱ ՄԻՋԱՎԱՅՐԻ ՎՐԱ ԱԶԴԵՑՈՒԹՅԱՆ ՓՈՐՁԱՔՆՆՈՒԹՅԱՆ

թիվ ԲՓ 0010-22

<15> 02 2022թ.

**Ազարակից թունելի ելք մոտ 32 կմ ճանապարհահատվածի, թունելի մուտքից դեպի Քաջարան մոտ 7 կմ ճանապարհահատվածի, 6 կմ թունելի և իջարեղերի ճանապարհների նախագծային փաթեթի շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն**

|                        |                                                                                                                                 |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Ձեռնարկող՝             | «ԱՅԵՌԴԻ ԷՆՋԻՆԻՐԻՆԳ» ՍՊԸ                                                                                                         |
| Փաստաթղթի տեսակը՝      | Շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն /ՇՄԱԳ/                                                                |
| Գործունեության տեսակը՝ | Ա կատեգորիա                                                                                                                     |
| Տեղադրման վայրը՝       | Սյունիքի մարզ, Լեռնաձոր, Քաջարան, Տաշտուն, Լիճք, Լեհվազ, Վարդանիձոր, Գուղեմնիս, Մեղրի և Կարճևան բնակավայրերի վարչական տարածքներ |

**Ներածական մաս:** «Հյուսիս-հարավ ճանապարհային միջանցքի ներդրումային ծրագիր»-ը (ՀՀՃՄՆԾ) խոշոր ենթակառուցվածքային նախագիծ է, որի նպատակն է 556 կմ ընդհանուր երկարությամբ Մեղրի-Երևան-Քաղաք ավտոմայրուղու միջոցով կամրջել Հայաստանի հյուսիսային և հարավային սահմանները՝ կրճատելով ճանապարհի երկարությունը շուրջ 85 կմ-ով, այն դարձնելով 470կմ: Տրանշ 4-ը Հյուսիս- հարավ ճանապարհային միջանցքի հարավային հատվածն է, որը բաղկացած է 3 հիմնական ճանապարհահատվածից և 8 երնթափահատվածից: Այն սկիզբ է առնում Արտաշատ քաղաքից և ավարտվում է Հայաստանի Հանրապետության և Իրանի Իսլամական հանրապետության ընդհանուր սահմանագծին: Տրանշ 4-ի Քաջարան-Ազարակ ճանապարհահատվածը (M2 ճանապարհի Քաջարան-Ազարակ հատված՝ 328+600 կմ-ից 384+000 կմ) ամենահարավային հատվածն է, որը Քաջարանից ձգվում է դեպի Իրանի սահման:

ՀՀՃՄՆԾ Տրանշ 4-ի՝ Քաջարան-Ազարակ ճանապարհահատվածի իրականացման համար Հայաստանի Հանրապետությունը և Կայունացման և զարգացման եվրասիական հիմնադրամի Եվրասիական Ջարգացման Բանկը կնքել են վարկային համաձայնագիր: Հայաստանի Հանրապետության տարածքային կառավարման և ենթակառուցվածքների նախարարությունը /ՏԿԵՆ/ ստանձնում է հայկական կողմից ծրագրի ընդհանուր համակարգման պատասխանատվությունը, իսկ «Ճանապարհային դեպարտամենտ» ՊՈԱԿ-ը նշանակվել է որպես Ծրագրի իրականացման գործակալություն (ԾԻԳ) առաջնորդվելով ՀՀ տարածքային կառավարման և ենթակառուցվածքների նախարարության ու Ճանապարհային դեպարտամենտի միջև կնքված գործակալական համաձայնագրով:

**Նկարագրական մաս:** Ընդհանուր առմամբ, Քաջարան-Ազարակ ճանապարհի 42.300 մ երկարությամբ ծրագիծն անցնելու է Սյունիքի մարզի թվով ինը բնակավայրերի տարածքներով /Լեռնաձոր, Քաջարան, Տաշտուն, Լիճք, Լեհվազ, Վարդանիձոր, Գուղեմնիս, Մեղրի և Կարճևան/, որից միայն 6,95 կմ հատվածը պետք է անցնի թունելով /Լեռնաձոր, Քաջարան և Տաշտուն համայնքների սահմաններով/:







Հյուսիս-հարավ ավտոմայրուղու Քաջարան-Վարդանիձոր հատվածը սկսվում է Լեռնաձոր գյուղի վարչական տարածքից, անցնելով M2 միջպետական ավտոմայրուղու ծրագծով՝ Լեռնաձոր գյուղից հետո մտնում է 7,2 կմ երկարությամբ կառուցվող թունել, այնուհետև անցնում է Տաշտունի լեռնանցք /2483 մ/ և դուրս գալիս Տաշտուն գետի անտառապատ ձորը: Մինչև Վարդանիձոր հասնելը այն հիմնականում անցնում է գործող ճանապարհի ծրագծով: Որոշ դեպքերում, շրջանցելով բնակավայրերը, կառուցվող ավտոմայրուղին հատում է անտառապատ տարածքներ, որոնք ծրագրի իրականացման ընթացքում կհայտնվեն ազդեցության գոտում: Ծրագրի անցնում է Տաշտուն և Մեղրի գետերի տարբեր հատվածներով, որոնց ձորերը ունեն խիստ բարդ ռելիեֆ, լանջերի թեքությունները հաճախ գերազանցում են 30 աստիճանը և անտառները կրում են հիմնականում պաշտպանական նշանակության:

Ճանապարհի ծրագծի համար ՇՄԱԳ-ում առաջարկվել են 3 այլընտրանքային տարբերակներ, որոնց 3-ի դեպքում էլ անխուսափելի են՝ բնության հատուկ պահպանվող և անտառային տարածքների, պատմամշակութային տարածքների, հնագիտական տեսանկյունից զգայուն հնավայրերի վրա հնարավոր բացասական ազդեցությունները, ինչպես նաև ծառահատումները և հողերի օտարումն ու մարդկանց տարարնակեցումը: Այլընտրանքների համեմատական վերլուծության արդյունքում և նանախընտրելի տարբերակի ընտրության պարագայում հաշվի են առնվել բնապահպանական, սոցիալական և մշակութային գործոնները:

Նախագծված 45 կմ երկարությամբ ճանապարհահատվածը Սիսիան-Քաջարան 60 կմ ճանապարհահատվածի շարունակությունն է: Առաջարկվող նախագիծը ներառում է M2 ճանապարհի Ագարակ-Քաջարան (328+600 կմ-ից 384+000 կմ) հատվածի մանրամասն նախագծային փաթեթը: Շինարարական աշխատանքները կիրականացվեն 32 կմ ճանապարհահատվածի՝ մոտ 21 կմ Ագարակից Վարդանիձոր (որից 5 կմ գոյություն ունեցող ճանապարհի լայնացում+16 կմ նոր ճանապարհ) և մոտ 11 կմ Վարդանիձորից թունելի ելք: Քաջարան-Ագարակ ճանապարհահատվածը հիմնականում տեղակայված է կիրճում:

ՀՀՃՄՆԾ Տրանշ 4-ի՝ Քաջարան-Ագարակ հատվածը բաղկացած է երկու մասից (Մաս/Լոտ 1 և Մաս/Լոտ 2) ընդհանուր երկարությունը 45 կմ է. որից՝

- 21 կմ Ագարակից Վարդանիձոր,
- 11 կմ Վարդանիձորից թունելի ելք (Մաս 1),
- 7 կմ թունելի մուտքից Քաջարան,
- 6 կմ թունել և իջատեղերի ճանապարհներ (Մաս 2):

Համաձայն առաջարկված նախագծի ճանապարհը նախատեսվում է կառուցել ասֆալտբետոնե ծածկով (100 կմ/ժ հաշվարկային արագությամբ): Այն բաղկացած կլինի գոյություն ունեցող երկու երթուղիների գոտիով ճանապարհի (մոտ 5 կմ՝ 379+000 կմ - 384+000 կմ) բարեկարգված ու լայնացված հատվածից և երկու երթուղիների գոտիով, կամուրջներով և թունելով նոր ճանապարհահատվածից: Աշխատանքները ներառում են նոր ճանապարհը գոյություն ունեցող M2 ճանապարհին և համայնքներին, ինչպես նաև ըստ անհրաժեշտության՝ տեղի բիզնեսներին միացնող հատումների (խաչմերուկների) նախագծում: Ճանապարհի հատվածի նոր ծրագիծը կկառուցվի ըստ ստանդարտների, որոնք կհանգեցնեն բարելավված ճանապարհի գծանշումների, ցուցանակների, թունելների, կամուրջների, ջրահեռացման, ջրատարների, գետնանցումների և խաչմերուկների բարելավմանը:

Ըստ նախագծի ընդհանուր առմամբ կլինեն՝ 14 կամուրջներ, 27 ջրատարներ, և 3 թունելներ,

1. (սկսած 3+700 կմ մինչև 10+900 կմ, 7200 մ);
2. (սկսած 16+300 կմ մինչև 16+700 կմ, 400 մ);
3. (սկսած 34+900 կմ մինչև 35+300 կմ, 420 մ);

Աշխատանքները նաև ներառում են ճանապարհին հանդիպակաց գոյություն ունեցող ենթակառուցվածքների հետազոտություններ և ուսումնասիրություններ, որոնք կարող են







խոչընդոտել շինարարական աշխատանքները կամ հետագայում նոր ճանապարհի շահագործումը:

Կոմունալ ծառայությունների տեղափոխումները ներառում են՝

- Խմելու ջրի խողովակաշարեր
- Ոռոգման ջրանցքներ / խողովակաշարեր
- Գազատարներ
- Էլեկտրական հոսանքի գծեր

Ակնկալվում է, որ շինարարությունը կիրականացվի 5 տարվա ընթացքում: Ժայռոտ տեղանքի պատճառով հողերի խոտածածկում չի նախատեսվում: Շինարարության ընթացքում առաջացող ավելցուկային բնահողը և հանվող ապարները ՀՀ օրենսդրական պահանջներին համապատասխան կդասակարգվեն և կտեղադրվեն համայնքների ղեկավարների կողմից հատկացված վայրերում, հետագայում կօգտագործվեն ըստ նպատակի:

Տարածաշրջանն ունի ուղղաձիգ ռելիեֆ, ամենացածր՝ 375 մ կետը գտնվում է Արաքս գետի հովտում, իսկ ամենաբարձր կետը՝ 3904 մ է (Կապուտջուղ լեռան գագաթը): Նկարագրվող տարածաշրջանում երկրաշարժերի հնարավոր ուժգնությունը կազմում է 6-8 բալ, առավելագույն հորիզոնական արագացումները 0,3-0,5g (Սեյսմիկ Պաշտպանության Ազգային Ծառայության տվյալների):

Ծրագրի իրականացման տարածաշրջանին բնորոշ է մասնատված, կառուցվածքային էրոզիոն-տեղատարումային ռելիեֆի տիպը՝ չափավոր զառիթափ, մեղմաթեք, մասամբ ժայռոտ լանջերով, թույլ ալիքավոր ջրբաժանով, հարթխանստվածքային ապարների ծայքաբեկորավոր կառույցներով, աստիճանակերպ կատարներով:

Ծրագիծը համարյա ամբողջությամբ (բացառությամբ թունելի հատվածի) անցնում է սկզբում Ողջի, ապա Մեղրի գետերի հովտով՝ բազմաթիվ անգամ կատարելով գետանցումներ: Ծրագրի համար հայցվող տարածքում բացակայում են լճեր և լճակներ, սակայն Ողջի և Մեղրի գետերի և դրանց վտակների ափերը հարուստ են մեզոֆիլ բուսականությամբ և առկա են գերխոնավ ցածրադիր հատվածներ: Այն հատում է էկոլոգիական համակարգեր՝ 1920մ ծ.մ. մինչև 540մ ծ.մ. բարձրություններում և կունենա անմիջական ու անուղղակի ազդեցություններ շրջակա միջավայրի ֆիզիկական և կենսաբանական ռեսուրսների վրա: ՇՄԱԳ հաշվետվության պատրաստումից առաջ իրականացվել են դաշտային հետազոտություններ՝ դիսկերի նույնականացման և համապատասխան միջոցառումների մշակման նպատակով /արդյունքները ներկայացվել են ՇՄԱԳ-ի հավելվածներում/:

Ծրագրի ազդեցության տարածքում բացահայտվել են հնարավոր ազդեցությունները (բացասական և դրական) ֆիզիկական, էկոլոգիական, հնագիտական և սոցիալ-մշակութային և տնտեսական ռեսուրսների վրա, ներառյալ՝ աշխատողների և համայնքի առողջությունն ու անվտանգությունը: Ի հայտ բերված յուրաքանչյուր ազդեցության համար, ըստ նշանակության և առաջացման, առաջարկվում է համապատասխան մեղմացնող միջոցառում Ծրագրի ողջ շրջափուլում սկսած նախագծումից, շինարարությանը նախորդող և ընթացիկ փուլերից, մինչև շահագործման և պահպանման ժամանակահատվածը:

Ուսումնասիրված տարածքներում հանդիպում են *բնական լանդշաֆտի* տարբեր տիպեր.

ա/ ճանապարհներ՝ երկկողմանի կամ միակողմանի առանձին **ծառերով և թփուտներով**,

բ/ անտառածածկ, հաճախ մեծ թեքության լեռնալանջեր,

գ/ անտառածածկ և թփածածկ ժայռեղեն լանջեր,





դ/ մշակվող և անմշակ այգիներ,  
ե/ գետեր, գետանցումներ,  
զ/ գետահովիտներ, ծածկված թփուտներով, միայնակ ծառերով կամ ծառախմբերով,

է/ թփուտներով ծածկված չոր բլրալանջեր և այլն:

Քաջարան- Ագարակ հատվածի կառուցման գոտին ընդգրկում է Զանգեզուրի ֆլորիստական շրջանի հարավային մասի և Մեղրու ֆլորիստական շրջանի որոշակի հատվածներ: Հայցվող տարածքում հանդիպող բուսականության տիպերն են՝

- Սաղարթավոր անտառները (կաղնու-բոխու, բոխու- կաղնու, կաղնու-բոխու-թխկու- և այլ համակեցություններ, հունամերձ անտառներ)
- Նոսրանտառները (սաղարթավոր նոսրանտառներ, խառը նոսրանտառներ, փշատերև նոսրանտառներ (գիհուտներ)
- Շիբլյակ
- Լեռնաչորասեր՝ ֆրիգանիդ (լեռնաքսերոֆիլ) բուսականություն (տրագականտային թփուտներ, լեռնային քսերոֆիտ մացառներ)
- Կիսանապատներ

Հայցվող տարածքում անտառները հիմնականում տեղաբաշխված են բարձր թերություններ ունեցող լանջերի (30% և ավելի) վրա, հանդիպում են կանու և բոխու գերակշռությամբ անտառային համակեցություններ: Կաղնու գերակշռությամբ լայնատաերև անտառ հանդիպում է Լեռնածոր գյուղի շրջանցման հատվածում և առաջին թունելի ելքից Մեղրի գետի աջափնյա լեռնալանջերին: Բոխու գերակշռությամբ սաղարթավոր անտառ հանդիպում է Գոզգոզ գետի կիրճի աջակոմյան լանջերին, մինչև երկրորդ թունելի մուտքը հատվածում: Ծանապարհահատվածի կառուցման արդյունքում ազդեցության ենթակա ծառերի ու թփերի տեսակները, ինչպես նաև դրանց քանակը պարզվել է դաշտային ուսումնասիրությունների ընթացքում /հաշվարկը կատարվել է հաշվի առնելով լանդշաֆտի առանձնահատկությունը/: Ըստ նախնական ուսումնասիրության՝ շինարարական աշխատանքների ընթացքում կհատվեն ավելի քան 19000 (19366) ծառեր: Թփերի կտրատումից և մաքրումից հետո կհատվեն ավելի քան 180000 (185659) թփեր: Անտառային տարածքների կորուստը գնահատվել է ավելի քան 170000 (173971)մ<sup>2</sup>: Ըստ հնարավորության հեռացված ծառերը նախատեսված է վերատնկել ուշ աշնանը՝ տերևաթափից հետո, կամ վաղ գարնանը: Կտրված/վնասված ծառաթփային բուսականությունը պետք է վերականգնվի 1:2 հարաբերակցությամբ (բացառությամբ Կարմիր գրքային տեսակներից, որոնք պետք է վերականգնվեն 10:1 հարաբերակցությամբ): Նոր ծառերը պետք է խնամվեն 3 տարի՝ մինչև դրանց կենսունակ դառնալը (80% գոյատևումը համարվում է գերազանց): Մանրամասն տեղեկատվությունը հատվող ծառերի և թփերի և վերատնկման տարածքների վերաբերյալ ներկայացված է ՇՄԱԳ հաշվետվության Հավելված-8-ում:

Հյուսիս-հարավ ավտոմայրուղու Վարդանիձոր-Ագարակ հատվածը գտնվում է ծ.մ. 540 – 1000 մ բարձրությունների վրա: Վերընթաց լանդշաֆտային գոտիներից այն ընդգրկում է մասամբ չոր տափաստանային ցածր լեռնային / ծ. մ. 1000 -1600 մ/ և կիսաանապատային լեռնահարթավայրային / ծ. մ. 500 – 1000 մ/ գոտիները:

Առաջարկվող ծրագծի երկայնքով բույսերի տեսակների ընդհանուր քանակը ուսումնասիրվել է բուսաբանի կողմից՝ պարզելու համար ազդեցության ենթակա ֆլորայի տեսակները: Ակնկալվում է, որ Ֆլորայի վրա մեծ ազդեցություն կբացահայտվի բուսականության կորստի կառաջացնի թունելի կառուցման աշխատանքների







մասնավորապես՝ թունելի ելքի հատվածում դեպի Մեղրի քաղաք /որը ներառված է («Արևիք» ազգային պարկի տարածքում/ և դրա մերձակայքում վերգետնյա ճանապարհի շինարարական աշխատանքները: Ֆլորայի մանրամասն նկարագրությունը, ներառյալ դիտարկվող տարածում և հարակից տարածքներում հանդիպող՝ վտանգված և ՀՀ Կարմիր Գրքում գրանցված բուսատեսակների նկարագիրը ներկայացված է Հավելված 6-ում: Համաձայն ՀՀ Կարմիր գրքի (ՀՀ կառավարության 29.01.2010թ N 72-Ն որոշում), ազդեցության ենթակա 55 տեսակներից անմիջական բացասական ազդեցություն կկրեն 17 բուսատեսակ, դրանցից յուրաքանչյուրի պահպանման համար ՇՄԱԳ հաշվետվության շրջանակներում ներկայացված են միջոցառումներ: Ազդեցության ենթակա տեսակների տեղափոխման համար վարձվելու է որակավորված բուսաբան: Եթե հնարավոր չէ բուսատեսակի տեղափոխումը (բազմամյա ծառեր, բարձր թփեր), անհրաժեշտ է հավաքել սերմեր, տեղի տնկարաններից մեկում տնկանյութ ստանալու և հետագայում տնկումների համար: Մանրամասն տեղեկատվությունը ներկայացված է ԲԿՊ-ում և Հավելված 8-ում:

Առանձնահատուկ ուշադրություն պետք է դարձնել տարածքում առկա պահպանվող կենդանատեսակներին՝ համաձայն «Կենդանական աշխարհի մասին» ՀՀ օրենքի (2000թ.) և ՀՀ կառավարության 2010 թ. հունվարի 29-ի N71-Ն որոշման պահանջների: Հատուկ մեղմացնող միջոցառումները ներառվել են ԲԿՊ-ում՝ կենդանական աշխարհի վրա բացասական ազդեցությունը նվազագույնի հասցնելու և Կարմիր գրքի տեսակների վրա ցանկացած վնասակար ազդեցությունից խուսափելու համար: Շինարարության ընթացքում այն մասերում, որտեղ փոքր կաթնասունների, սողունների ու երկկենցաղների մեծ քանակներ են հավաքվում, մասնագետները պետք է հավաքեն վերջիններիս ու բաց թողնեն ավելի հարմար ու ապահով վայրերում: Կենդանատեսակների հավաքումը պետք է իրականացվի նախքան ծանր շինարարական տեխնիկայի օգտագործումը: Բնակեցված բների հայտնաբերման դեպքում, դրանք նույնպես պետք է տեղափոխվեն համապատասխան մասնագետի հսկողության ներքո՝ նախքան շինաշխատանքների մեկնարկը: Դաշտային այցելությունների ընթացքում ուսումնասիրվել է նաև հնարավոր միգրացիոն ուղիների տեղակայությունը: Ուսումնասիրությունները ցույց են տվել, որ նոր ճանապարհի ամբողջ երկայնքով բացակայում են կենդանիների միգրացիոն ուղիները: Նախատեսվող ջրահեռացման համակարգի (ջրթող խողովակներ, ուղղանկյուն խողովակներ) տեղադրումը կծառայի որպես անցում կենդանիների համար:

Նախագծված ճանապարհահատվածը հիմնականում անցնում է «Արևիք» ազգային պարկի հարևանությամբ, սակայն որոշ հատվածներ /Մեղրու տարածաշրջանում/ շրջափում են «Ջանգեղուր» կենսոլորտային համալիրի տարածքը («Արևիք» ազգային պարկ) հետևյալ հատվածներում՝

- 1 մաս-նախատեսվող թունելի ելքից ներկա M2 ճանապարհի լայնացում՝ մոտ 2.5 կմ
- 2 մաս - Վանք-Կալեր խաչմերուկի հատվածում՝ մոտ 1.2 կմ
- Այլ հատվածներ (3-4 տեղ)՝ մոտ 100-250 մ:

ՇՄԱԳ հաշվետվության պատրաստման ընթացքում մասնագետական խմբի կողմից /կենդանաբաններ, բուսաբաններ, հնէաբաններ և «Ջանգեղուր» կենսոլորտային համալիրի ՊՈԱԿ-ի ներկայացուցիչներ/ իրականացվել են դաշտային հետազոտություններ և ուսումնասիրություններ՝ «Ջանգեղուր» կենսոլորտային համալիրի վրա հնարավոր բացասական ազդեցությունների, ինչպես նաև դիսկերի նույնականացման նպատակով /Հավելված 13-ում/: Հետազոտությունների արդյունքում





լուրջ ռիսկեր չեն բացահայտվել, իսկ բնության հատուկ պահպանվող տարածքների վրա բացասական ազդեցությունը մեղմելու ընդհանուր միջոցառումները ներկայացված են ԲԿՊ-ում: Հատուկ պահպանվող և զգայուն տարածքների համար պետք է մշակվի մոնիտորինգի և կառավարման հատուկ պլան Կապալառուի կողմից:

Կատարված մանրամասն ուսումնասիրությունների արդյունքում բացահայտվել է, որ 2008 թվականի օգոստոսի 14-ի N 967 որոշմամբ ընդունված ՀՀ բնության հուշարձանների ցանկում ընդգրկված Սյունիքի մարզում առկա բնական հուշարձաններից ոչ մեկը չի ենթարկվի որևէ ազդեցության Ծրագրի իրականացման ընթացքում, քանի որ Ծրագրի ազդեցության գոտուց գտնվում են բավականին մեծ հեռավորության վրա:

Դաշտային աշխատանքների արդյունքում ծրագծի ողջ երկայնքով փաստագրվել է 19 միավոր պատմամշակութային հուշարձան, որոնից 14-ը գտնվում են ծրագրի անմիջական ազդեցության տարածքում: Ծրագրի նախապատրաստման ընթացքում հնարավոր ազդեցություն կրող պատմամշակութային հուշարձանները մանրամասնորեն ուսումնասիրվել են, արդյունքները ներկայացված են ՇՄԱԳ հաշվետվության Հավելված 9-ում, դրանց պահպանության համար ներկայացվել են համապատասխան լուծումներ:

Ծրագրի ակնկալվող ազդեցությունները կենսաֆիզիկական միջավայրի վրա (ինչպիսիք են հողի էրոզիան, աղմուկի և թրթռման բարձր մակարդակները, օդի և ջրի որակը), ժամանակավոր բնույթ կկրեն և ի հայտ կգան միայն շինարարության ընթացքում: Այդ ազդեցությունները կառավարելի են և հնարավոր կլինի դրանք նվազեցնել կամ ընդհանրապես վերացնել Բնապահպանական կառավարման պլանում առաջարկված մեղմացնող միջոցառումները ժամանակին և ճիշտ իրականացնելու միջոցով: Շրջակա միջավայրի պահպանությունը, հանրության և շինարարության աշխատողների անվտանգությունը և աշխատողների հիգիենան Ծրագրի բոլոր փուլերում լիովին կհամապատասխանեցվեն ՀՀ օրենսդրական կանոնակարգերին և ֆինանսավորող ու խորհրդատու միջազգային կազմակերպությունների պահանջներին:

Ջրի աղտոտումը հնարավոր է 14 կամուրջների շինարարության ընթացքում, վտակների ու գետերի վրա, ինչպես նաև 3 թունելների շինարարության ընթացքում: Պոտենցիալ ազդեցությունները կապված են վառելիքի ու յուղերի պատահական արտահոսքերի, հանված հողի հեռացման, շինաշխատանքներից հետո թողնված շինանյութերի հետ, որոնք կարող են լցվել ջրային ռեսուրսների մեջ և հանգեցնել ջրային ռեսուրսներում նստվածքների և ջրի որակի անկման:

Նետկյալ միջոցառումները պետք է իրականացվեն՝ ջրի որակի վրա ազդեցությունը նվազեցնելու/սահմանափակելու համար՝

- Շինհրապարակում և դրա շուրջ ջրահեռացման ու գետի հունի պահպանում՝ բացառելով հանույթի կամ շինաշխատանքներից որևէ մասնիկների ներթափանցումը ջրերի մեջ,
- Կամուրջի շինարարության գործողություններ, ներառյալ՝ ցցերի տեղադրումն իրականացնել ամռանը և ձմռանը, երբ ջրի մակարդակը գետերում ցածր է կամ երբ սեզոնային վտակներում չոր շրջան է,
- Վառելիքի արտահոսք ունեցող սարքերն ու մեքենաները պետք է արգելել,
- Բոլոր քիմիկատներն ու վառելիքը պահել ջրային ռեսուրսներից հեռու,
- Շինհրապարակում մեքենաների ու սարքերի վառելիքի համար նախատեսված տարածքները ընտրել վտակներից ու գետերից հեռու,







- գտիչների տեղադրում՝ հեռացնելու համար նավթա վառելիքի համար տրամադրված տարածքներից,
- Տիղմից պատնեշների տեղադրում՝ նստվածքները հավաքելու և հավաքված թիղմը/նստվածքները կրկին օգտագործման համար,
- Որևէ մեքենա կամ սարք չպետք է լվացվի, կայանվի կամ լցավորվի վտակների կամ գետերի մոտ,
- Բոլոր շինհրապարակները պետք է գտնվեն գետերից առնվազն 1կմ հեռավորության վրա,
- Կամուրջների վրա կուտակված անձրևաջրերը կամուրջների տակ գտնվող նավթի գտիչներով անցկացնելուց հետո հեռացնել գետ,
- ջրահեռացման կառույցների նախատեսում՝ ջրի բնական հոսքը ճանապարհի լիցքով ավելի դյուրին դարձնելու համար:
- Արտակարգ իրավիճակներին արձագանքնելու պլանի մշակում, որը կներառի վտանգավոր արտահոսքերի մշակման գործողությունները:

Թունելների համար նախատեսված հատուկ մեղմացնող միջոցառումները ներառում են՝

- Ջրակամեկուսիչ համակարգի տեղադրում հիմքի հենարանային մասի և բետոնի վերջնական երեսպատման շերտի արանքում, որը կազմված կլինի ՊՎԲ թաղանթից՝ գետտեքստիլ նյութից պաշտպանիչ շերտերով:
- Ճանապարհի երթևեկելի մասի ջրերի հավաքում ջրահեռացման համակարգով: Քանի որ թունելը բաց կլինի տրանսպորտային երթևեկության համար, դրենաժային համակարգը կազմված կլինի անցքերով ջրորդաններից: Այն կմիանա հիմնական երկայնական ջրատար առվին հեղեղաջրերի հորերի միջոցով՝ միանալով սիֆոնային համակարգին:
- Ջրահավաք ազանների տեղադրում ճակատային մուտքերում, որտեղ կհավաքվեն ջրահեռացման համակարգով հեռացվող ջրերը՝ նախքան դրանց շրջակա տարածքներ լցվելը:

Թունելների փորումը կպահանջի նստվածքային ապարներից կազմված երկրաբանական ռեսուրսների անջատում, իսկ պայթեցման աշխատանքները կհանգեցնեն ժայռերի տեղաշարժի, փոքր ճեղվածքների և թրթռման առաջացման: Կընդունվի պայթեցման համապատասխան ձև, որով հաշվի կառնի անվտանգությունը:

Նախքան շինարարությունը, օտարման գոտում գտնվող հողերն ու շինությունները պետք է օտարվեն քանդվեն: Կկատարվի ամբողջական սոցիալական ազդեցության գնահատում և կմշակվի Հողի օտարման ու տարաբնակեցման ծրագիր: Հողի օտարումը կիրականացվի՝ համաձայն ՀՕՏԾ-ի (ՀՕՏԾ ընդհանուր նկարագրությունը և սկզբունքները համառոտ ներկայացված է Հավելված 9-ում

| Նշանակություն                                                          | Քանակ մ <sup>2</sup> |
|------------------------------------------------------------------------|----------------------|
| Անտառային                                                              | 72,681.00            |
| Արդյունաբերության, ընդերքօգտագործման եւ այլ արտադրական նշանակության    | 16,919.00            |
| Բնակավայրերի                                                           | 290,410.00           |
| Գյուղատնտեսական                                                        | 922,953.00           |
| Էներգետիկայի, տրանսպորտի, կապի, կոմունալ ենթակառուցվածքների օբյեկտների | 111,706.00           |
| Հատուկ պահպանվող տարածքների                                            | 19,931.00            |
| Զրային                                                                 | 47,033.00            |





Շինարարության ընթացքում կառուցվող ճանապարհին մոտ գտնվող համայնքները կկրեն շինարարությանն առնչվող ժամանակավոր անհարմարություններ, ներառյալ՝ աղմուկ, փոշի, շրջանցիկ մուտքեր:

Հիմնական ազդեցությունները ներառում են փոշու առաջացում՝ գործարաններից, մեքենաներից, շինանյութերի բոլոր տեսակի փախադրումներից, հանքավայրերից ու քարհանքերից շինանյութերի տեղափոխումից ու բեռնաթափումից, ժայռային զանգվածների կտրելուց ու հորատումից և այլ շինարարական աշխատանքներից: Առաջացած փոշին կարող է անմիջական ազդեցություն ունենալ աշխատողների վրա ու ճանապարհի ծրագծի մոտ բնակվողների վրա, մասնավորապես նրանց, ովքեր բնակվում են քամու ուղղությամբ: Բետոնի ու ասֆալտի գործարանները, ինչպես նաև քարի մանրացման մեքենաները մոտակա զգայուն ազդառուներից (օրինակ՝ բնակավայրեր, պահպանվող տարածքներ) կտեղադրվեն առնազն 1 կմ հեռավորության վրա: Ճանապարհի մակերեսներին, հանույթի ու շինարարության հրապարակներում նախատեսված է ջրցանի իրականացում՝ դրանք խոնավ պահելու ու փոշին նպատակով, իսկ հող, ավազ կամ քարեր տեղափոխող բեռնատարերը պետք է ծածկված լինեն: Արտանետումների վերահսկման նպատակով տեղադրվելու են հսկիչ սարքեր և իրականացվելու է կանոնավոր մոնիտորինգ շինարարական ճամբարներում ու ճանապարհի շինարարությանը մոտ գտնվող բնակավայրերում /ինչը սահմանված է Մոնիտորինգի պլանով/:

Շինարարական աշխատանքների տևողությունը կկազմի 5 տարի, շինարարական տեխնիկական և բեռնատար մեքենաները կաշխատեն՝ 50 ամիս: Շինարարական աշխատանքների ընթացքում հիմնական արտանետումները առաջանում են հողային աշխատանքների և շինարարական տեխնիկայի ու տրանսպորտային միջոցների շահագործման ժամանակ, ասֆալտապատման արդյունքում:

Արտանետումների ընդհանուր քանակները ներկայացված են ստորև՝ աղյուսակում:

Շին.աշխատանքների արդյունքումները

| N | Վնասակար նյութը                                  | Արդյունքումների քանակները<br>շինարարության արդյունքում, տ |
|---|--------------------------------------------------|-----------------------------------------------------------|
| 1 | Անօրգանական փոշի                                 | 1150                                                      |
| 2 | Ածխածնի մոնօքսիդ                                 | 880                                                       |
| 3 | Ածխաջրածիններ                                    | 203.35                                                    |
| 4 | Ազոտի օքսիդներ (հաշվարկված որպես ազոտի երկօքսիդ) | 1026.6                                                    |
| 5 | Պիտեղ մասնիկներ                                  | 104.06                                                    |
| 6 | Ծծմբի երկօքսիդ                                   | 96.8                                                      |

Արտանետումների ազդեցությունը գնահատելու նպատակով կատարվել են մթնոլորտում դրանց ցրման հաշվարկ և արդյունքները համեմատվել են սանիտարական նորմերի հետ: Ստորև բերված են հաշվարկների արդյունքները երկու պայմանական հարթակների համար, մեկը Քաջարանի խմբի, մյուսը Մեղրիի խմբի:

Գերհամերձ կոնցենտրացիաների հաշվարկների արդյունքները

| N | Աղտոտող նյութը   | Առավելագույն միանվագ ՍԹԿ, մգ/մ <sup>3</sup> | Առավելագույն գետնամերձ կոնցենտրացիաները |              |                   |
|---|------------------|---------------------------------------------|-----------------------------------------|--------------|-------------------|
|   |                  |                                             | Քաջարանի խումբ                          | Մեղրիի խումբ | ՍՊՄՏ՝ 3183        |
|   |                  | ՍԹԿ մասով                                   | մգ/մ <sup>3</sup>                       | ՍԹԿ մասով    | մգ/մ <sup>3</sup> |
| 1 | Անօրգանական փոշի | 0.5                                         | 0.4                                     | 0.2          | 0.4               |







|   |                          |      |                           |        |                           |        |
|---|--------------------------|------|---------------------------|--------|---------------------------|--------|
| 2 | Ածխածնի օքսիդ            | 5.0  | 0.08                      | 0.4    | 0.08                      | 0.4    |
| 3 | Ածխաջրածիններ սահմանային | 1.0  | 0.0009                    | 0.0009 | 0.0008                    | 0.0008 |
| 4 | Ազոտի երկօքսիդ           | 0.2  | 0.04 (0.05 <sup>1</sup> ) | 0.008  | 0.04 (0.05 <sup>2</sup> ) | 0.008  |
| 5 | Պինդ մասնիկներ /մոլդ/    | 0.15 | 0.0093                    | 0.0014 | 0.0077                    | 0.0012 |
| 6 | Ծծմբային անիդրիդ         | 0.5  | 0.04                      | 0.02   | 0.04                      | 0.02   |

Քաջարան - Ագարակ ավտոճանապարհի հատվածի շինարարության արդյունքում հաշվարկված տնտեսական վնասը կկազմի՝ 349107430 դրամ:

Շինարարական աշխատանքների ընթացքում ջուրը օգտագործվում է տեղանքի ջրցանի, հողային զանգվածի խոնավացման, ինչպես նաև, շինարարական անձնակազմի խմելու, կենցաղային կարիքների համար:

Նախատեսվում է միաժամանակ շահագործել 7 շինհրապարակ: Մեկ հրապարակի ջրապահանջը կկազմի՝ 1728 մ<sup>3</sup>/շին.ժամանակահատված: Աշխատողների խմելու և կենցաղային պահանջների համար ջրածախսը կկազմի 62832մ<sup>3</sup>: Ջրամատակարարումը իրականացվելու կառուցվող ճանապարհի երկայնքով գտնվող համայնքային ջրացանցերից, համայնքների լիմիտների հաշվին:

Աշխատակիցների կենցաղային կարիքների համար (սանհանգույցներ, սննդի սենյակներ, այլ) նախատեսվում է վարձել տարածքներ ճանապարհի երկայնքով գտնվող բնակավայրերում: Տարածքները ապահովված կլինեն ջրամատակարարման և կոյուղու համակարգերով:

Ճանապարհի տեղանքի և շինարարական հրապարակների նախապատրաստման ընթացքում փորվում և հանվում է հող և գրունտ՝ 6000000 մ<sup>3</sup> ծավալով: Այս հանույթի մի մասը՝ 1200000 մ<sup>3</sup>-ը օգտագործվում է որպես ետլիցք, իսկ մնացած մասը՝ 4800000 մ<sup>3</sup> ճանապարհի ներքին և եզրային շերտերի ձևավորման, ինչպես նաև տեղանքի հարթեցման և բարեկարգման համար: Նախատեսվող ճանապարհի շինարարության ենթակա տեղանքի բերրի հողաշերտը մեծամասամբ տատանվում է 15 – 25 սմ սահմաններում: Հողի բերրի շերտի հանման ենթակա ընդհանուր ծավալը կազմում է մոտ 105000 մ<sup>3</sup>: Բերրի հողը կոտակվելու է այդ նպատակի համար աշխատանքային հարթակների մոտ նախատեսված 5 լցակույտերում և օգտագործվելու է տվյալ տեղանքի բարեկարգման համար: Լցակույտերի տեղադիրքը, կոորդինատները, բնութագրերը և քարտեզագրական նյութերը բերված են հավելված 10-ում:

Աշխատանքների ընթացքում մի քանի տեղամասերում հատվելու են ծառեր: Հատվող ծառերի տնկման դիմաց նախատեսված գումարները արտահայտում են նաև այն վնասը, որը առաջանում է Ծրագրի շրջանակներում ծառերի հատման արդյունքում: Ընդամենը նախատեսվում է հատել 19366 ծառ: Նախնական հաշվարկներով ծախսերը կկազմեն՝ 19366 հատ x 2 : 1500հատ x 3.0 մլն.դրամ = 77.46 մլն.դրամ: Հարկ է նշել, որ մասնավոր սեփականությունից ծառերի կորուստը (և ցանկացած առնչվող ձեռնարկատիրական գործունեության կորուստ) ենթակա է փոխհատուցման Հողի օտարման և տարաբնակեցման ընթացակարգերի շրջանակում:

Թափոնների առաջացման աղբյուրները դասակարգվել են հիմնական /շինարարություն/ և օժանդակ /ավտոտրանսպորտային և շինարարական տեխնիկայի սպասարկում, մատակարարում, աշխատողների կենցաղային սպասարկում/ և ներառում են՝ բանեցված շարժիչների յուղերի թափոններ,





դողաձածկաններ, բանեցված կապարե կուտակիչներ և խոտան, չտեսակավորված պողպատ պարունակող թափոններ, շինարարական աղբ, կենցաղային աղբ և այլն/, որոնց հեռացման համար ներկայացվել են համապատասխան լուծումներ:

Կապալառուի և Ինժեների կողմից աղմուկի մակարդակի մոնիտորինգի ծրագիր կիրականացվի՝ աղմուկի ստանդարտներին համապատասխանություն ապահովելու համար: Մոնիտորինգը կիրականացվի շինարարական ճամբարներում և ճանապարհաշինական ակտիվ ճակատներին մոտ գտնվող բնակավայրերի տարածքներում, ինչպես նախատեսված է Մոնիտորինգի պլանում:

Աղմուկի նվազեցման մեղմացնող միջոցառումները, որոնք կկիրառվեն հետևյալն են՝

- Շինարարական ճամբարները տեղադրել բնակավայրերից հեռու,
- Աղմկաշատ գործողությունները հնարավորության դեպքում իրականացնել ընկալիչներից հեռու,
- Աղմկաշատ գործողությունները կազմակերպել ցերեկվա ժամերին՝ խուսափելով գիշերային ժամերին աշխատանքներ կատարելուց,
- Հնարավորինս նվազեցնել ծանր սարքավորումների տեղափոխումը բնակավայրերին մոտ տարածքներով՝ հանրապետական ճանապարհների երկայնքով սահմանելով հատուկ ուղիներ, մուտքեր՝ դեպի շինհրապարակ և շրջանցիկ ճանապարհներ,
- Սարքավորումների վրա տեղադրել աղմկակլանիչ սարքեր,
- Եթե վերը նշված մեղմացնող միջոցառումները բավարար կամ կիրառելի չեն, տեղադրել ժամանակավոր ձայնամեկուսիչ և ձայնակլանիչ արգելքներ թունելների մուտքի և աղմուկի աղբյուրների մոտ:

Կապալառուն պետք է ձեռք բերի բոլոր անհրաժեշտ թույլտվությունները երթևեկության ուղղությունների առնչությամբ և պատրաստի Երթևեկության կառավարման պլան մոբիլիզացիայի ընթացքում, որտեղ կսահմանվեն անվտանգ մուտքի և ելքի կետերը, կնախատեսվեն անվտանգության խիստ միջոցառումներ

Ճանապարհային նշաններ պետք է տեղադրվեն՝ նվազեցնելու համար արագությունն ու կրճատելու համար դժբախտ պատահարները: Պետք է լինեն շրջանցիկ ճանապարհներ, ինչպես նաև երթևեկության նախազգուշացնող նշաններ՝ համայնքներում վթարներից խուսաթելու համար:

Կապալառուն պետք է ունենա անվտանգության ու առողջապահության պլան, ինչպես նաև վերապատրաստված առաջին օգնության անձնակազմ ու արտակարգ իրավիճակներին արձագանքող սարքավորումներ:

Մինչև շինարարական աշխատանքների ավարտը և օբյեկտը շահագործման հանձնելը, Կապալառուն պետք է վերականգնի շինհրապարակը, որը կներառի տարածքի մաքրում բոլոր շինարարական նյութերից և թափոններից: Կանաչապատման աշխատանքերը կներառեն տեղական ծառատեսակների և թփերի տնկում, ինչպես նախատեսված է ՇՄԱԳ-ում: Բոլոր հեռացված ծառերն ու թփերը, պետք է փոխարինվեն տեղանքին բնորոշ ծառերով և թփերով՝ 2:1 հարաբերակցությամբ: Կապալառուն պետք է ապահովի տնկված բուսականության պահպանումը, շինարարական աշխատանքներից հետո կվարձի մասնագիտացված կազմակերպություններ՝ ծառերը և թփերը խնամելու համար:

Բնապահպանական կառավարման պլանում (ԲԿՊ) /որը հանդիսանում է վերջնական ՇՄԱԳ-ի անբաժանելի մաս և կներառվի մրցույթային և պայմանագրային փաստաթղթերում/ ներկայացվում է մեղմացնող միջոցառումներ, որոնք անհրաժեշտ է ձեռնարկել ծրագրի իրականացման ընթացքում՝ շրջակա միջավայրի վրա բացասական





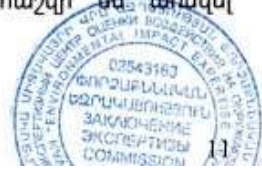
ազդեցություններից խոսափելու, դրանք նվազեցնելու կամ մեղմացնելու համար: ՇՄԱԳ հաշվետվությունում առաջարկվող մեղմացնող միջոցառումները ներկայացվել են 13 ենթապլաններով, որոնք հիմնված են լավագույն բնապահպանական կառավարման միջազգային փորձի վրա: ԲԿՊ-ում ներառված են հնարավոր ազդեցությունները, առաջարկվող մեղմացնող միջոցառումները և դրանց իրականացման պատասխանատու մարմինները, մոնիտորինգի գործողությունները և գնահատված ծախսերը: ԲԿՊ-ն կարող է ուղեցույց հանդիսանալ ՏԿԵՆ -ի և այլ համապատասխան իրավասու մարմինների /ներառյալ ԲԸՊՏ-ի/ համար՝ շինարարության, շահագործման և սպասարկման ժամանակահատվածներում:

**Եզրափակիչ մաս:** Ռազմավարական կարևոր նշանակություն ունեցող այս ճանապարհի կառուցումը կապահովի Հայաստանի հարավային սահմանից դյուրին երթևեկությունը մինչև Վրաստանի սահման, ապա նաև՝ դեպի Սևծովյան նավահանգիստներ, թույլ տալով իրականացնել եվրոպական չափանիշերին համապատասխանող բեռնափոխադրումներ և ուղևորափոխադրումներ և ընձեռնել երկրի տնտեսական զարգացման հնարավորություններ: Ծրագիրը կապահովի Ազարակի և Քաջարանի տարածաշրջանների հեռավոր համայնքների միջև կապը, իսկ շինարարական աշխատանքների ընթացքում կունենա դրական ազդեցություն համայնքների համար՝ աշխատատեղերով ապահովման տեսանկյունից:

Ծրագրի իրականացման արդյունքում, գոյություն ունեցող 556 կմ երկարությամբ, 60 կմ/ժ հաշվարկային արագությամբ երկրորդ՝ տեխնիկական կարգի ճանապարհը կվերափոխվի 470կմ երկարությամբ 100կմ/ժ հաշվարկային արագությամբ ավտոճանապարհի, արդյունքում ճանապարհն անցնելու համար նախկին 9-9,5 ժամի փոխարեն կպահանջվի 4,5 ժամ, ինչպես նաև կբարելավվի երթևեկության հարմարավետությունն ու անվտանգությունը:

Շինարարության ընթացքում ճանապարհի մոտակա համայնքները ժամանակավոր կենթարկվեն բացասական ազդեցությունների (փոշու արտանետումներ, աղմուկ, ճանապարհների անհասանելիություն և այլն), սակայն դրանք կլինեն կարճաժամկետ և ԲԿՊ-ում նախատեսված միջոցառումների իրականացման շնորհիվ կհասցվեն թույլատրելի նորմերի սահմաններին:

Շրջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության գործընթացներում ՀՀ օրենսդրությամբ սահմանված կարգով իրականացվել են հանրային իրազեկումներ և քննարկումներ (ՀՀ Սյունիքի մարզի Քաջարան և Մեղրի համայնքներում), հանրության կողմից հնչեցված դիտողություններն ու առաջարկություններն ընդունվել և հաշվի են առնվել շրջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության գործընթացներում: Քննարկման ընթացքում բարձրացվել է հարցեր՝ անտառպատման աշխատանքների իրականացման տարածքների, ծառերի կաշոճականության և ոռոգման ապահովման, նվաճ աշխատանքները բնակիչների կողմից վերահսկողության և թունելի կառուցման ժամանակ պայթեցման աշխատանքների հնարավոր ազդեցությունների վերաբերյալ: Փորձաքննության գործընթացում ծրագրի վերաբերյալ ստացվել են կարծիքներ՝ ՀՀ ԿԳՄՍ, առողջապահության, արտակարգ իրավիճակների, ՏԿԵ նախարարությունների, քաղաքի կոմիտեի և կադաստրի կոմիտեի, ինչպես նաև շրջակա միջավայրի նախարարության ստորաբաժանումների կողմից, որոնք ևս հաշվի են առնվել փորձաքննական գործընթացում:









9. Տնկման ենթակա ծառերի և թփերի տեսակային կազմը և տնկման աշխատանքներն անհրաժեշտ է իրականացնել շրջակա միջավայրի նախարարության՝ Անտառային կոմիտեի և Քաջարան և Մեղրի համայնքների ղեկավարների հետ համաձայնեցված /պահպանելով 3-5 տարի խնամքի և կպչողականության ապահովման միջոցառումները/, անտառպատման աշխատանքների համար ՀՀ օրենսդրական պահանջներին համապատասխան մշակել նախագծեր և դրանք համաձայնեցնել պետական լիազոր մարմնի հետ:
10. Շինարարության ընթացքում անհրաժեշտ է ապահովել ԲԿՊ-ում և քննապահպանական մոնիթորինգի պլանում առաջարկվող միջոցառումների և մոնիթորինգային դիտարկումների իրականացումը և ժամանակացույցերը, որոնց արդյունքները պետք է հասանելի լինեն պետական շահագրգիռ մարմիններին և հանրությանը:

### ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ

«Հյուսիս-Հարավ ճանապարհային միջանցքի ներդրումային ծրագիր», Տրանշ` 4. Ազարակից թունելի ելք մոտ 32 կմ ճանապարհահատվածի, թունելի մուտքից դեպի Քաջարան մոտ 7 կմ ճանապարհահատվածի, 6 կմ թունելի և իջատեղերի ճանապարհների նախագծային փաթեթի շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվության վերաբերյալ տրվում է դրական եզրակացություն, վերը նշված պահանջների պարտադիր կատարման պայմանով:

«Շրջակա միջավայրի վրա ազդեցության փորձաքննական կենտրոն» ՊՈԱԿ-ի գլխ. մասնագետ



Մկրտչյան

Ընդամենը՝ 13 էջ