MASTARA RESERVOIR PREPARATION PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR MASTARA RESERVOIR CONSTRUCTION PROJECT

June - 2018

WATER SECTOR PROJECT IMPLEMENTATION UNIT

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Content

Acronyms

AMD	Armenian Dram
DM	Distance Mark (or "Picket Number")
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
EIMC	Environmental Impact Monitoring Centre
EMP	Environmental Management Plan
IES	Initial Environmental Study
Environmental Expertise	State Environmental Expertise SNCO of the MNP
IREP AF	Irrigation Rehabilitation Emergency Project of Additional Financing
ESAOC	Environmental and Social Assessment and Oversight Consultant
FS/FD Consultant	Feasibility Study/Final Design Consultant
FSL	Full Supply Level
GDP	Gross Domestic Product
GoA	Government of Armenia
HGSN	HGSN (Haygyughshinnakhagits) LLC Design Consultant
IBRD	International Bank for Reconstruction and Development
ICID	International Commission on Irrigation and Drainage
ISEP	Irrigation System Enhancement Project
LLC	Limited Liability Company
EIAE	Environmental Impact Assessment and Expertise
MNP	Ministry of Nature Protection of the Republic of Armenia
MoA	Ministry of Agriculture of the Republic of Armenia
NGO	Non-Governmental Organization
NSS	National Statistical Service of the Republic of Armenia
O&M	Operation & Maintenance
RAP	Resettlement Action Plan
RA	Republic of Armenia
RPF	Resettlement Policy Framework
SCWE	State Committee of Water Economy of the RA MoA
SEI	State Environmental Inspectorate
SNCO	State Non Commercial Organization
USD	Dollars of the United States of America
WB	World Bank
WRMA	Water Resources Management Agency
WSA	Water Supply Agency ("Vorogum-Jrar" CJSC)
WS PIU	Water Sector Projects Implementation Unit State Institution
WTM	Water-to-Market Activity of the MCA-Armenia Program
WUA	Water User Association

EXECUTIVE SUMMARY

Introduction

After independence the economic structure of the Republic of Armenia (RA) has significantly changed. The former industrial republic became an agrarian country. However, the agrarian economy faces significant challenges related to the lack of modern irrigation systems. The Government of the RA makes major efforts to solve this issue including both its own resources and those of the international organizations. With the World Bank (WB) support the Government of the RA implemented the Irrigation Development Project, and the Dam Safety Projects I and II. These projects conducted the most critical interventions helping to secure operation of 8 major irrigation systems. Another World Bank-supported project is the Irrigation Rehabilitation Emergency Project (IREP). At present, the Irrigation System Enhancement Project (ISEP), including construction of gravity schemes and rehabilitation of main and secondary canals and funded by the WB, as well as construction of Baghramyan-Norakert tertiary network by the WB additional funding are nearing to end. Meanwhile, a new Irrigation Systems Modernization Project funded by Eurasian Development Bank (EDB) aims at construction of gravity schemes, rehabilitation of main and secondary canals and tertiary networks.

RA has received a grant from the Europe and Central Asia Region Capacity Development Multi-Donor Trust Fund governed by the WB. The development objective of the Grant-financed operation is to carry out the feasibility study, prepare the Preliminary Design and undertake Environmental and Social Impact Assessment (ESIA) for the construction of Mastara Reservoir, as well as preparation of other Project documents. The Project also aims at strengthening capacity of the Water Sector Project Implementation Unit State Agency (WSPIU) of the State Committee of Water Economy under the Ministry of Energy Infrastructure and Natural Resources in the areas of procurement, monitoring and assessment for the preparation and execution of the Project.

Environmental Impact Assessment

The 10th article of the RA Constitution (adopted in 1995) defines that the government is responsible for environmental protection and reproduction and rational use of natural resources. Laws of environmental and natural resources were issued on the environmental protection. The environmental impact assessment system in Armenia follows the RA law on the Environmental Impact Assessment and Expert Examination adopted on 21 June 2014. This law regulates public relationships in the field of environmental impact assessment and environmental impact state expertise in the RA. The legislation on the assessment and expertise consists of the RA Constitution, international contracts with the participation of the Republic of Armenia, this law, other legal acts and sub-legislative acts.

According to the classification of the Article 14 of the RA law on Environmental Impact Assessment and Expert Examination (EIAEE), the activities in water sector:

(a) Reservoirs, artificial lakes and pools with the size of 1million m^3 and more are classified to the Category A.

Mastara Reservoir construction and operation is classified to Category A and requires environmental expert examination implemented in two phases.

Provisions of other laws (listed under section 2.1) on the environmental protection were also taken into consideration during assessment of this report.

Mastara Reservoir design and construction activities trigger WB OP/BP 4.01 **Environmental Assessment**. Based on the nature and scope of physical activities required for the construction of the reservoir, as well as the general types of impacts expected from such kind of construction, it is classified as environmental Category A and requires ESIA. The present ESIA report was developed by the ESIA Consultant based on review of environmental and social screening results implemented by the Design Consultant as well as on the results of thorough environmental examination of the reservoir area and social studies conducted in affected communities.

Mastara Reservoir Project (MRP) envisages construction of a Dam and reservoir so it triggers OP/BP 4.37 **Safety of Dams**.

MRP also triggers WB OP/BP 7.50 **Projects on International Waterways.** Apart from the waters of Selav Mastara mudflow, Akhuryan River which is a transboundary river with the riparian Turkey, will also feed the reservoir with water.

MRP triggers OP/BP 4.09 **Pest Management** because it is anticipated that the improved irrigation services will intensify agriculture in the service area, and higher value crops may be cultivated, which could entail more intensive use of pesticides.

MRP also triggers OP/BP 4.12 **Involuntary Resettlement** as the construction of the reservoir will require land acquisition. The Project will permanently acquire **68.630** ha of land plots according to Full Supply Level (FSL) at 950m design option or **75.303** ha of land according to FSL at 951.5m design option.

Project Description

Water shortage in Armenia in terms of severe continental climate is more vividly felt in irrigation sector of agriculture. Therefore, reservoir construction is the only means for water collection. The objective of this project is to construct Mastara reservoir in Armavir Marz (Province), in the bed of Selav Mastara River, 4km north to Armavir canal, on administrative areas of Dalarik and Lernagog communities.

The reservoir construction will allow to provide gravity irrigation water to the communities located downstream Armavir canal from 27th km and to stop operation of deep wells and to decrease annual water intake from Ararat valley underground basin with about 3.3million m^3.

The guaranteed low-cost irrigation water volumes have essential significance for reinforcement and development of agriculture. It will enhance production of agricultural goods and will increase incomes of rural population.

The reservoir will be filled from two feeding sources – flood flows of Selav Mastara and Akhuryan Rivers. Selav Mastara River originates from the feet of Mount Aragats at the height of 3,000m and its flow is formed mostly from melted snow waters and rainfalls in its water basin (the flow is about 5.3mln m^3). About 6.6mln m^3 free flows of Akhuryan River is not used during non-irrigation II-III, IV (1st half) and XI months of the year for irrigation or other purposes (the free flow is about 42/41mln. m^3). The water will be conveyed to Mastara reservoir through the tunnel of Talin irrigation scheme and Talin main canal.

The Project, as designed, will include the construction of the following structures:

Item	Description
Dam	
Type	A rock fill dam with geomembrane upstream surface with about 1.2M m^3 volume. The dam body will consist of rock fill transition materials and concrete bed for geomembrane cover.
Crest Width	8.0m
Crest Length	1100.0m
Fetch Length	770.0m
Normal Wave Freeboard	0.97m
Normal water level	951.5 m.a.s.l.
Crest level	954.5 m.a.s.l.
Diversion System	
Type	Cut and cover concrete culvert
Design flood return period	20-years
Design peak discharge	56.7m^3/sec
Conduit Type	Horse Shoe Culvert

Culvert Diameter	4m (height and width)
Culvert Length	105m
Culvert Slope	1%
Culvert Entrance Ele.	928 masl
Upstream Cofferdam Height	5.5m
Down Cofferdam Height	2.0m
Bottom Outlet	
Intake Entrance Ele.	935masl
Trashrack Dimension	2.7×2.2m (w×h)
Head Gate Bulkhead	1.6×1.6m
Transmission Conduit Pipe	900mm
Conduit Length	87m
Guard Gate Bonneted Slide	800×800mm
Service Gate Bonneted Slide	600×600mm
Discharge Capacity	5.8 m3/sec
Reservoir Evacuation Time	14.7 days
Stilling Basin Type	II USBR
Stilling Basin Width	6.0m
Stilling Basin Length	8.0m
Irrigation Intake	
Intake Entrance Ele.	935masl
Trashrack Dimension	2×1.2×1.6+2×1.6m (w×h)
Head Gate Bulkhead	1.2×1.2m
Transmission Conduit Pipe	1200mm
Conduit Length	113m
Guard Valve Butterfly	1200mm
Service Gate Howell Bunger	800mm
Discharge Capacity	3.9cm/sec
Spillway	
Design Flood	100 yrs 135cm/sec
Control Flood	1000 yrs 265cm/sec
Spillway Net Width	24m
Normal Water Level	951.5m asl
Design Level	953.1m asl
Control Level	954m asl
Chute Start Width	26.0m
Chute End Width	10.0m
Chute Length	146.0m
Energy Dissipator	Flip Bucket with 10m Radius
Jet Impact Length	23.0m
Jet Scour	8.0m
Diversion pipeline downstream the reservoir	
Length	4550 m
Diameter	900 mm
Discharge Capacity	1.3cm/sec
Alternative road	
Lenght	1520m
Width	6.8m
Type	Asphalt road, to be constructed on the right bank above the dam crest level

Methodology

Environmental Study Methods

The botanist, zoologist and water ecosystem specialist of the Consultant's (Subcontractor's) team have explored the area envisaged for the reservoir and have conducted visual observation of the sites to check preliminary information from the existing literature and to reveal additional aspects that are not published. Preliminary information has been collected on biophysical environment of the Project affected area.

Based on the collected data the Consultant has defined the sensitive environmental components and has assessed possible environmental and social impacts for both the construction and operation stages of the reservoir.

Social Study Methods

At the feasibility stage of MRP, the ESIA Consultant conducted social studies including qualitative surveys and social-economic analysis to assess social impact in the affected and beneficiary communities. The aim of the qualitative surveys was to identify and discuss irrigation related issues of the communities and to reveal concerns and needs of different groups in the communities, and their expectations from the reservoir construction project.

Environmental Baseline

The area claimed for the Mastara Reservoir is located in the Armavir region of Armenia, on the southwestern foothills of Mount Aragats, between Myasnikyan and Dalarik communities. The water basin of Selav Mastara River is formed on Karmrashen and Talin plateaus of southern slopes of Mount Aragats. The Karmrashen plateau is located on the southwestern foothills of Mount Aragats between Akhuryan and Araks rivers. With the physical-geographical regions and natural landscape zones Mastara reservoir area is located in the middle Araks Province (IV) Ararat region (18) Armavir-Artashat (18a) subregion.

The relief of the reservoir area is diverse. The right bank of the river can be characterized with rugged slops of the river, composed of accumulative (sedimentary, spatial) alluvial-prolevial sediments. The left bank of Selav Mastara River is characterized with an erosion volcanic relief on a slightly corrugated base. The flow of volcanic rocks have created wavy terrain, hillsides, on tops of which the outbreaks of the original rocks can be seen.

According to the schematic zone map of Mastara reservoir, the area is considered to have *horizontal acceleration of the ground* v = 30cm/cm^2 a= 0.4g (the magnitude of acceleration during the earthquake on the upper surface of the ground layer with horizontal direction) which is equivalent to 3-9 magnitude earthquakes.

The area is located in the "warm" climatic zone on the schematic map of climate circles. This climatic zone covers the altitudes up to 1200m above sea level and is characterized by the following climatic parameters: summer is hot, dry, the average temperature in July is 210C, relative humidity (by 15 o'clock) is 35% lower, there are favorable mountain winds with average speed of 2.0-3.0 m/s.

Winter is cold, unwindy, average temperature in January from 0°C to -5°C, relative humidity 60-70% (at 15 o'clock), the average speed of wind is 2.0-3.0m/s.

All the rivers in the area are considered as the left tributaries of Araks River. The main source of water in the study area is Akhuryan River. Selav Mastara River is involved in Metsamor River Basin of Akhuryan River's water-management area.

The reservoir is located near the Ararat Valley artesian basin which is considered to be strategic drinking water resource of Armenia.

The main soil types of Armavir Marz are arable gray meadow soil, gray semi-desert and hydromorphic salt-alkaline soils. There are also some outbreaks of original rocks.

The area is predominantly semi-desert which is a natural habitat for the following types: Salsola dendroides and Alhagi pseudoalhagi. This kind of natural habitat is typical to Ararat Valley.

Watershed and mesophyll species grow on the by-river banks of Mastara River flowing across the area. During drought years, the mudflow bed dries up. An irrigation canal also passes through the area and there are some moisture-growing plants along its edges.

Some part of the area is covered with rocks, covered with a special petrofilic vegetation.

The fauna of the area is poor. The observations of mammals are mostly random. Most often, traces of their activities can be observed.

Social Baseline

Armavir Marz (Province) is located in western part of Armenia. Agricultural lands of the Marz occupy 97,076.1ha of land or 78.2% of the entire administrative area of the marz; 63.5% of all agricultural lands are arable which is 7.6% of all agricultural lands and 31% of all arable lands in the country.

The population of Armavir Marz is 8.9% of total population in the country. 31.7% of population lives in urban, 68.3% in rural areas.[1] The geographic location and the climate are favorable for cultivation of berries, fruit, wine yard, vegetables as well as for cattle breeding, pig and poultry farming.

The poverty level in Armavir Marz in 2016 was 30%. Decreasing from 34.3% in 2012 by 4.3% and increasing from 29 . 6% in 2015 by 0 . 4% it is close to 29.4%, the average poverty level in Armenia.

Mastara reservoir will be built on the lands of Dalarik and Lernagog communities will supply Myasnikyan, Khanjyan, Lukashin, Hatsik, Norapat and Noravan communities with gravity irrigation water. Social studies were conducted in 8 communities including the 6 beneficiary communities to assess the social impact of the project.

The affected communities, Dalarik, Lernagog, Myasnikyan, Khanjyan, Lukashin, Hatsik, Norapat and Noravan, located in Armavir Marz on distance of 45-65km from the capital Yerevan, are mostly engaged in agricultural activities – land cultivation and cattle breeding. In some communities there are ethnic minorities: 5% of Khanjyan community population are Yezidis. In Dalarik and Norapat there are Russians and Yezidis, in Myasnikyan Yezidis and Kurds, in Hatsik and Noravan Yezidis.

Environmental and Social Impacts

Mastara reservoir construction will result in positive changes in irrigation water supply to 6 beneficiary communities. It will irrigate 4,384 ha of total land in beneficiary communities and will provide 4,432 water users with gravity irrigation water which is more favorable with its quality for crops compared with the water pumped out from artesian wells.

The reservoir construction will increase the reliability of irrigation water supply encouraging farmers to cultivate expensive crops. In the result of the Project Implementation the expected positive social impacts will have long-term nature and will contribute to improvement of social-economic conditions in the affected area.

Environmental Impacts in the Construction Phase

During the construction phase, some negative influences may be observed on the environment, such as surface water pollution, transformation of landscape, land erosion, which may be a result of excavated/extracted earth, not proper removal/placement of the disposed soil and construction waste, leakage of fuels and lubricants and other materials during the construction, use of temporary construction

[1] Source: NSS, Number or permanent population as of January 1, 2016, (http://armstat.am/file/article/nasel_01.01.2016.pdf)

site (const. camps, car parks, storages, etc.), temporary pollution of the air caused by the dense traffic schedule during the construction, noise and vibrations during the excavation work, also possible impacts on the vegetative cover.

Soil works such as drilling, excavation and transportation will cause dust emissions; construction machinery operation will cause burnt fuel emissions.

Social Impacts in the Construction Phase

- Temporary impacts related to construction
  (a) Increased traffic
  (b) Blocked access
  (c) Increased noise and dust
  (d) Increased health problems
  (e) Accidents at construction site
- Temporary land use Impacts
- Opportunities for temporary local employment
  (a) Temporary employment opportunity for local non-qualified labor
  (b) Unequal opportunity for women to benefit from temporary emplyment
- Irrigation water supply interruption
- Workers' camps management and community health and safety issues including potential risks related to the presence of large number of external workers.

The adverse impacts on the communities affected by the project implementation are basically related to construction works, and have temporary and short-term impacts. These impacts may be avoided or decreased by the effective implementation of the social and environmental mitigation measures provided in the Enviornmental and Social Management Plan (ESMP) included in the present report. ESMP will be followed by the construction contractors, technical supervision and design consultants as well as other supervising entities.

Environmental Impacts in the Operation Phase

The reservoir is a significant contribution to efficient use of irrigation water as a natural resource. The construction of the reservoir will allow to increase irrigated land surface and to prolong the irrigation season which will slow down desertification process.

At the same time, the reservoir will have some insignificant negative impact. The reservoir is envisaged to be constructed on Selav Mastara mud flow which is not considered to be a natural water resource. However, the reservoir operation will have an impact on water balance of the flow.

Social Impacts in the Operation Phase

Economic gains of communities in the coverage area

Discussions with the project beneficiaries showed that vast majority believes their overall living quality will increase, number of labor migrants will decrease, poverty rate will be moderated as a result of the project implementation. The reservoir construction will lead to better service provision and will result in higher yields.

Competition for water use

The beneficiary communities - especially those located at the final part of the scheme - have concerns that the reservoir water will be insufficient to cover all their irrigation needs.

Mitigation and Enhancement Measures

Mitigation and enhancement measures are proposed for the design, construction and operation phases of MRP that shall be undertaken by executing agencies to prevent and/or minimize the likely adverse environmental and social impacts listed above.

Environmental and Social Impacs Mitigation in the Design Phase

Environmental and social mitigation measures are incorporated in the final design, technical specifications and bidding documents to be implemented by the construction contractor and the system operating entity to avoid, prevent, minimize, or rehabilitate the potential impacts.

The affected communities will be informed on grievance procedures and Grievance Redress Mechanism (GRM) through which the communities can raise their problems, concerns and complaints, express their feedback to the WSPIU and Construction Contractor on construction process and to receive timely coordinated responses. The WSPIU and the Contractor will coordinate this process.

Environmental Impact Mitigation in the Construction Phase

Measures to prevent and/or minimize the degradation of landscapes and soil erosion, pollution of surface and groundwater resources and soils by construction run-off shall be implemented by the contractor during the construction phase. This must include, but not be limited to:

- The construction sites and the approaching roads shall be periodically watered to minimize the construction resulted dust,
- The main source of dust emissions is transportation means and techniques so it is envisioned to periodically checked their technical condition and to make regulations,
- The transportation of construction materials and waste should be organized by the use of covered trucks,
- Maintenance and washing services of the vehicles and machinery should be implemented at the service centers of the nearby communities,
- Placing garbage containers at the staff resting places to avoid littering the soil with communal waste,
- Prohibition of moving vehicles and machinery outside the existing or designated access roads.

Social Impact Mitigation in the Construction Phase

Temporary impacts related to construction: The Construction Contractor should properly inform the affected communities about the commencement of construction works which can cause temporal inconveniences such as closed roads, increased dust and noise. The Contractor will implement the following measures to mitigate such impacts:

(a) Increased traffic - The Contractor will offer an alternative road bypassing the construction site.
(b) Blocked access - The Contractor will locate construction camps and machinery far from residual areas, public facilities, private assets and/or lands to avoid blocking access.
(c) Noise and dust - Install construction camps as far as possible from the inhabited areas; carry out noisy works during day hours; Install noise absorber plants on machine equipment.
(d) Health problems - To avoid allergic, respiratory and other health problems the construction materials use by the contractor should comply with international standards.
(e) In order to avoid or reduce safety risks associated with the construction works, the following mitigation measures are proposed:

- Raise awareness of negative impacts during construction works;
- Ensure that workers and any visitors are provided and use personal protective gear;
- Insure that workers receive worksite safety training,

- Insure that workers operating large equipment are properly trained and licensed
- Ensure that construction equipment is inspected and licensed
- Ensure that construction equipment is used strictly following its operation instructions;
- Keep first aid medical kits and fire-fighting equipment on site
- Disallow on-site activities beyond the working hours.
- Ensure that active work sites are fenced so that children/people cannot access and become injured.

Temporary Land Use: Preliminary Agreements from communities permitting implementation of the project related activities in the community during construction are included in Annex 5. Later before the start of construction works the WSPIU will get permissions for construction works from local authorities.

During the construction phase in exclusive cases, when there is no possibility to avoid the temporary use of lands, which were not previously included in the design, the Contractor should agree in writing the terms of temporary land use including rental payments, reinstitution, and other relevant issues. Template of such an Agreement can be developed during the final design stage.

Temporary Local Employment for non-qualified labor**:** Employment for women will be encouraged.

Irrigation Water Disturbance: The construction activities, which might hinder irrigation water supply to the affected communities through existing irrigation schemes, should be postponed to non-irrigation season.

Construction camps related impacts: The construction contractor will obtain the community agreements to install construction camps on unused community lands far from residual areas or will sign a lease contract with the community for land use. The contractor will also seek to maintain positive relationships and regular communications with local communities through a community relations focal point, raise the awareness of its employees in proper community engagement and penalize unethnical behaviors. Detailed labor camp management plan will be prepared during the detailed design phase.

Environmental Impact Mitigation in the Operation Phase

As it has been mentioned above the operation of the reservoir will allow to improve the land cultivation process, to preserve topsoil qualities and to create more favorable climatic conditions.

However, in order to ensure water balance, it is necessary to follow the design regimen of the reservoir level shifts.

Social Impact Mitigation in the Operation Phase

Competition for water use - Equitable distribution of reservoir water between the beneficiary communities as well as between water users in each community inside the communities as per water requirements of the cultivated crops should be managed by the Water User Associalations (WUAs) responsible for irrigation water supply of those communities - Armavir WUA (Khanjyan, Lukashin, Hatsik, Norapat, Noravan communities) and Shenik WUA (Myasnikyan community).

Cultural Heritage Impact Mitigation

The state list of immovable monuments of history and culture in the Armavir Marz has been approved by the Government Decree No 0389-N of 03.10.2002 and Decree No 456-N of 12.04.2007. In the above mentioned two lists, there are no registered historical and cultural monuments in the territories of Dalarik and Lernagog communities.

If during construction work historical-cultural monuments or other cultural materials are discovered, the Contractor will immediately interrupt the work and present a corresponding report to the State agency for protecting historical-cultural monuments. The specialists of the agency will carefully study the

discovered material and give their professional conclusion, based on which the works will either go on, or the design will be reviewed.

Grievance Redress Mechanism

The grievance redress mechanism (GRM) is a system through which people will be able to communicate their questions and concerns regarding the project and be assured of a timely response. The WSPIU has established a Grievance Redress Committee (GRC) to address affected people's concerns and complaints proactively and promptly, using an understandable, communicated, and transparent process that is gender responsive, culturally appropriate, and accessible to all segments of the affected people and beneficiary community at no cost The GRC consist of the environmental and social specialists, an engineer and the lawyer of the PIU. The GRC will collaborate with local authorities and will involve them in the Grievance Redress Mechanism. Local authorities will provide information to their communities how to express their grievances through various channels (in person to local focal points, over phone, email or online) and will support them if needed. The complaints and grievance from the stakeholders, affected communities and NGOs will be submitted to WSPIU GRC.

Arrangements for Environmental and Social Safeguards' Application and Reporting

Environmental and Social Safeguards application is the responsibility of all the agencies involved. The executing agencies are responsible for carrying out mitigation measures prescribed through the ESIA report and ESMP. The design phase executor-the designer consultant should guarantee that before declaring competition for construction works all the required permissions and agreements have been acquired from the corresponding authorized state and local authorities (such as: about the usage of water resources and systems, the areas of excavated soil, wastes and construction waste removal). The construction phase executing agencies (construction contractors) are responsible for executing monitoring measures provided in ESMP as well as for requiring all the permissions and agreements concerning the construction works (such as: acquire agreement with state agency of history and protection of cultural monuments, in case if historical/cultural/ancient monuments or other cultural materials unexpectedly appear during construction works).

All this will be carried out according to the demands of existing environmental and social legislation of Armenia as well as this ESIA report and ESMP requirements. Acting in the capacity of the Project implementing entity, SCWE will have an overall responsibility for the Project oversight, and will provide supervision of its implementation through the PIU. The PIU will hire a supervising company licensed to carry out technical supervision of construction, which will include oversight on the environmental and social compliance of works. The role of the PIU will be quality control of the supervision company's work and will imply periodic field visits of the PIU's in-house staff with the purpose of verifying information provided by the supervisor. PIU shall review and provide feedback on the supervision company's reports, as well as take timely and effective actions on the issues raised in the supervisor's reports. PIU will also track procedures of obtaining all necessary permits, licenses, and agreements by the works contractor and will follow compliance of works with the terms and conditions that these permits, licenses, and agreements. According to RA legislation, environmental supervision in the entire territory of the republic is carried out by the State Environmental Inspectorate operating under the Ministry of Nature Protection of RA, which also has a corresponding territorial department in the region of Armavir. The specialists will implement environmental supervision in the Project implementation area both during the construction and future operation stages.

Environmental and Social Management Plan

The present ESIA report carries an ESMP, which is designed to ensure that all necessary measures are identified and implemented in order to mitigate possible negative environmental impacts of the construction and operation phases and to comply with the national environmental legislation. The ESMP

will be included in tender documents and will become an integral part of the works contract. The construction contractor will be responsible to carry out all the measures anticipated by the ESMP during the construction. Supervision of the ESMP implementation will be carried out by PIU at the construction phase and will pass on to the WUA at the operation phase.

Public Participation

At the feasibility study stage several public consultations and discussions on environmental and social issues related to irrigation area tobe served by Mastara Reservoir were held with representatives of Shenik and Armavir WUAs, village mayors and other affected people. Having accomplished some preliminary studies at MRP area, the ESIA Consultant held the first public discussions in the Project affected communities Dalarik and Lernagog, in the RA Armavir Marz on December 22, 2017. During the public consultation meetings the preliminary design was presented to the communities.

Later the ESIA Consultant applied to the RA Environmental Impact Expert Examination Center SNCO for ESIA expertise in compliance with the RA Law on Environmental Impact Assessment and Expert Examination. On February 6, 2018, the SNCO held the second public discussions and on March 30, 2018, the Consultant held the third public discussions in the Project affected communities Dalarik and Lernagog.

1. GENERAL INFORMATION

The Republic of Armenia is a landlocked country (29,800 km^2) between the Black and Caspian seas, bordered in the north by Georgia, to the east by Azerbaijan, on the south by Iran and to the west by Turkey (Figure 1). The country's terrain is a high plateau with mountains with little forest land. Climate is highland continental with hot summers and cold winters. Armenia's natural resources are molybdenum, zinc, gold, silver, lead, marble, granite and mineral spring water.

Picture 2.1. Map of the Republic of Armenia

Armenia's population is officially estimated at 3,018,854 de jure (2,871,771 de facto) according to the final results 2011 census, announced in 2013[2]. 98% of the population is ethnic Armenian, 1.2 % Yezidi, 0.5% Russian, 0.3% other.

Armenia's work force is estimated at 1.24 million and the unemployment rate stands at 10.5%. Employment of the work force in Armenia's economy is described as follows: industry and construction – 24.5%; agriculture and forestry – 24.6%; trade – 17.3%; education – 13.4% other - 22.2%.

As a result sectors such as construction and services currently replace agriculture and industry as the main contributors to economic growth. Other industrial sectors driving the country's industrial growth include energy, metallurgy and food processing. According to preliminary data in 2011 the Gross Domestic Product (GDP) comprised AMD 3776.4 billion (USD 1= 405.32 AMD as of December 1, 2012), with 4.7% growth rate. Volume of gross agricultural output was estimated at around 20.2%, an increase compared to an average 17.6% in the last 4-year period. The structure of Armenia's economy has changed substantially since its independence in 1991. Irrigated agriculture has declined significantly due to non-operational mechanical irrigation (high electricity prices) and deteriorated infrastructure due to a lack of recurrent expenditure and maintenance. This, amongst other contributing factors, has caused severe unemployment, especially in rural areas. Reforms supported by international donors have been and continue to be undertaken to rehabilitate the economic situation in the country.

According to the "Social Snapshot and Poverty in Armenia, 2012"[3] (a study prepared by the NSS), poverty still remains a problem in Armenia. In 2011 the poverty level accounted for 35.0%, which is lower as compared to the previous year (35.8%). In 2011, more than third of population (35%) was poor, 19.9% was very poor and 3.7% was extremely poor. In 2014, Poverty was still at 30 percent.[4]

The Government of RA, with significant support from international institutions, continues strengthening its macro-economic management. The Irrigation System Enhancement Project (ISEP) is designed for the implementation over the four years, based on the loan agreement between the World Bank and the Republic of Armenia, aiming at improvement of irrigation infrastructure, and capacity building of Water User Associations (WUAs).

[2] National Statistical Service of the Republic of Armenia. Official web-site of the NSS of the RA: http://www.armstat.am/en/.
[3] Social Snapshot and Poverty in Armenia, 2012. National Statistical Service of Armenia.
[4] World Bank. 2016. Performance and Learning Review for the Republic of Armenia for the Period FY2014 – FY2017

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1. National Legislative Framework

Article 10 of the Constitution of the Republic of Armenia (adopted in 1995) guarantees protection of the environment by the State, as well as the rational use and renewal of natural resources. To fulfill this obligation, the Republic of Armenia has adopted a number of environmental laws and regulations since its independence in 1991 and also signed and ratified a list of international conventions and protocols. Table 3.1 below lists a number of the RA environmental laws referring to implementation of various component to raise irrigation projects reliability and efficiency.

Table 2.1. Selected Environmental and Transparency Laws of the Republic of Armenia

Name of Law	Year of Adoption
RA Law on Atmospheric Air Protection	1994
RA Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment	1998
RA Law on Environmental Fees and Nature Use Charges	1998
RA Law on Flora	1999
RA Law on Fauna	2000
RA Land Code	2001
RA Law on Lake Sevan	2001
RA Law on Complex Program for the Lake Sevan Ecosystem Restoration, Conservation, Reproduction and Use	2001
RA Water Code	2002
RA Law on Water Users' Associations and Federations of the Water Users Associations	2002
RA Law on Seismic Protection	2002
RA law on the freedom of information	2003
RA Law on Wastes	2004
RA law on public administration and administrative procedures	2004
RA Law on Environmental Oversight	2005
RA Forest Code	2005
RA Law on Fundamental Provisions of the National Water Policy	2005
RA Law on the National Water Program	2006
RA Law on Specially Protected Areas	2006
RA Law on Inspection of Use and Protection of Land	2008
RA Code on Underground Resources	2011
RA Law On Environmental Impact Assessment and Expert Examination	2014
RA Government Decree on Procedure for Organization of Public Outreach and Discussions	2014

Below are the main provisions of the laws that refer to environmental and social analyses of Mastara reservoir construction project.

Constitution

According to the Constitution (adopted in 1995 and amended in 2005), the Republic of Armenia is a sovereign, democratic and a social state governed by the rule of law. Article 10 of the **Constitution** of the Republic of Armenia defines the State responsibility for environmental protection, reproduction, and wise use of natural resources.

Law on Environmental Impact Assessment and Expert Examination (2014)

Each planned construction, reconstruction, expansion or other activity, which has impact on the environment, must undergo expertise according the Law "On Environmental Impact Assessment and Expert Examination" (2014). The law defines the measurements of the types of activities, which should be subject to such expertise. The types of activities according to their impact package are divided into 3 categories. These categories have been defined by taking into account the volume, character and measure of impact of the activities on the environment. The category A includes such massive industrial activities, for which the practice shows that the impact on the environment is great. The category B includes practically the same types of activities in less sizes or productivities. The category C includes types of activity with minimal risks for the environment and do not require impact assessment. The law gives general provisions for organization of public consultations; and the RA Government Decree, 19 November 2014, N 1325-N on Procedure for Organization of Public Outreach and Discussions regulates the procedure for organization and the number of public discussions/hearings, as well as states the roles and responsibilities of the entities/participants involved in this process. The expertise of Category A and B projects is implemented in 2 stages: preliminary and main; as well as organization of at least 4 public discussions by the project initiator (in most cases the initiator of the project is the design consultant) or an authorized agency for expert examination or local authorities. One of the public hearings should be held before the submission of the project to the Environmental Expert Examination, while the other(s) at later stages of the examination process. The expertise of Category C projects is implemented in 1 stage with least 2 public hearings. According to the classification of the Article 14 of this Law projects of "*Reservoirs, artificial lakes and pools with the size of 1million m^3 and more*" are classified to the Category A. *Mastara Reservoir construction and operation is classified to Category A project.*

Law on Flora (1999) and Law on Fauna (2000)

The Laws on Flora and Fauna outline the Republic's policies for the conservation, protection, use, regeneration, and management of natural populations of plants and animals, and for regulating the impact of human activities on biodiversity. These laws aim for the sustainable protection and use of flora/fauna and the conservation of biodiversity. There are provisions for assessing and monitoring species, especially rare and threatened species. This Law considered important application particularly for the reservoir construction project, since the State Environmental Inspectorate will be guided by the provisions of the law when controlling the construction works of this system.

Law on Atmospheric Air Protection (1994 and last amended in 2007)

This Law regulates the emission licenses and provides maximum allowed loads/concentrations for atmospheric air pollution, etc. There is secondary legislation that establishes sanitary norms for noise in workplaces, residential and public buildings, residential development areas as well as construction sites. The institutions of atmospheric air protection and control (The State Environmental Inspectorate, the Center of the Environmental Impact Monitoring) shall be guided by the provisions defined by this Law during the construction works of the reservoir.

Land Code (2001)

The Land Code defines the main directives for use of the lands allocated for energy production, water economy (water supply, water discharge, pumping stations, reservoirs, etc.), 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 at protection of the lands as well as the rights of state bodies, local authorities and citizens towards the land. The land code is one of those legal documents the categories, the samples of use permission, property forms and the other norms defined by it were taken into account during the designing stage of Mastara reservoir. The provisions defined by this Law (protection of the land resources,

regulating the use area) should be applied by the Construction Contractor and the organizations implementing supervision.

Water Code (2002)

The main purpose of the Water Code is to provide the legal basis for the protection of the country's water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations. The Water Code addresses the following key issues: responsibilities of state/local authorities and public, development of the national water policy and national water program, water cadaster and monitoring system, public access to the relevant information, water use and water system use permitting systems, trans-boundary water resources use, water quality standards, hydraulic structures operation safety issues, protection of water resources and state supervision.

The provisions defined by this Code are of key importance for almost all designing stages developed for water resources including all stages of MRP design. It regulates legal relations of water resources conservation, management and efficient use of them. In particular the water use permissions, priorities, and other concepts are regulated although not directly by legal acts ensuing from this code or dealing directly with it. Besides, the provisions defined by this code will be the basis for the institutions involved in the program as for the control of water resources conservation to the possible leaks to that environment.

Law on Water Users' Associations (WUA) and Federations of the WUAs (2002)

The WUAs and Federations of WUAs are established to effectively operate and maintain the irrigation infrastructure and organize impartial and equitable distribution of irrigation water to all water users, collect water payments and present and protect the rights of member water users raising their awareness of the association's activities and increasing their participation in WUA management. Within the objectives of the Association and Federation (Article 4) the following important issues from environmental and social perspectives could be mentioned: operation and maintenance of irrigation system; implementation of construction works and restoration of watercourses and irrigation systems; introduction of new irrigation technologies; organization of training courses on the use of new technologies to upgrade knowledge and skills of water users; water supply management and pollution prevention; implementation of activities necessary to improve the quality of land, supporting the drainage system; providing ecological safety through preventing land erosion, prevention from salinization, over-watering and promoting the protection of irrigation system.

This Law in general regulates the activity of Water User's Associations, and those companies are closely involved in such water sector projects designing, construction and operation stages- to determine the water request volume, types of crop, the space of the lands subjected to irrigate or be irrigated, the current situation of the irrigation systems, etc.

Law of RoA on Seismic Protection (2002)

This law prescribes the basics for the organization of seismic protection in the Republic of Armenia and regulates the provisions connected with them. Specific disaster risk reduction provisions include: chapter 4 which covers assessment and reduction of seismic risk; article 14 which focuses on the preparation of government bodies and local authorities to the management of seismic risk; article 22 which focuses on the basic tasks of seismic risk reduction; articles 24 which includes provisions dealing with structural safety; article 28 which focuses on methods of early warning and notification; article 31 which focuses on the principles of recovery, and article 32 which focuses on the essence of recovery works.

Law on Wastes (2005)

The law provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes as well as prevention of negative impacts of waste on natural resources, human life and health. The law defines the roles and responsibilities of the state authorized bodies in the waste sector. In the scope of the provisions defined by this Law the waste collection processes in the construction phase of the reservoir and the transportation of them to the certain places, as well as possible issues and relations between different institutions will be regulated by it.

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 over the implementation of environmental legislation, 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. Government resolutions are the main legal implementing instruments for environmental laws. The environmental field is also regulated by presidential orders, Prime Minister's resolutions and ministerial decrees. For the construction of Mastara reservoir the State Environmental Inspectorate will be guided mainly by this Law while implementing environmental control.

Law on Fundamental Provisions of the National Water Policy (2005)

The Law defines a long-term development concept for protection, strategic management and use of water resources and water systems of Armenia. It spells out the key principles for integrated management and planning of Armenia's water sector by defining priorities and approaches to be addressed. Article 13 of this Law in particular, regulates the priorities of water resources conservation and use, which served an important basis in the design phase of Mastara reservoir, and will also be acceptable in the further stage of the operation – to regulate the water use priorities in different areas.

Law on National Water Program (2006)

The overall goal of the Law is to provide short-term (until 2010), medium-term (2010-2015) and long-term (2015-2021) measures for achieving the goals and objectives defined by the Water Code, National Water Policy and Program. The National Water Program Law is a "living" document to be updated regularly. The law defines the following key measures: development of measures aimed at definition of the national water reserve; strategic water reserve; useable water resources and conservation and enhancement of the national water reserve; classification of water systems; development of criteria for defining the water systems of state significance; assessment of water demand and supply; development of a strategy for storage, distribution and use of water resources; definition of measures aimed at development of water standards; volumes of ecological/minimum flow volumes and maximum permissible quantities of water withdrawn for consumption; determination of specially protected basin areas and zones of ecological emergencies and ecological disasters; prevention of negative impact on water eco-systems; improvement of water resources monitoring and pollution prevention; determination of financial requirements and proposed funding sources suggested for implementation of the National Water Program; ensuring public awareness; etc.

Law on Inspection of Use and Protection of Land (2008)

This law provides objectives and types of effective use and protection of lands of the Republic of Armenia, inspection related to enforcement of land legislation and institutions, procedures of control, rights and responsibilities of entities controlling land use and protection. The law applies to all lands of the Republic of Armenia Land Fund, irrespective of purpose, ownership and/or right to use.

The provisions defined by this Law can be applicable especially during the construction phase of the reservoir in the context of land resources protection, in the scope of use relation regulation between the responsible institutions, partners and especially local authorities/self-governing entities.

Law on Social Protection of Disabled People (1993)

This Law establishes the legal, economic and organizational basis of social protection of disabled people in the Republic of Armenia, basic provisions of the state policy in provision to disabled people of optimum conditions and privileges on implementation of their rights and capabilities for the purpose of providing for them peer with other citizens of the republic of possibilities. During the distribution of irrigation water the requirements of this law will be taken into account, in order to make sure to the rights of the disabled people are protected.

Law on Equal Rights and Equal Opportunities for Women and Men (2013)

The law defines the guarantees for ensuring equal rights and equal opportunities of men and women in political, social, economic, cultural and other fields and regulates the relationships arising with the regard thereto. It also prohibits gender-based discrimination. The requirements of this law will be considered while offering temporary employment to local communities during the construction stage and during irrigation water distribution, so as men and women will enjoy equal rights for employment and water use.

A number of other laws and regulations were consulted during the conduct of the ESIA, primarily those regulating the construction sector and defining construction norms and standards (SNiPs).

In addition to the aforementioned legal acts, the Republic of Armenia has signed and ratified a number of environmental conventions and protocols which are presented below in Table 3.2. Highlighted items are most relevant to this ESIA.

Table 2.2. Overview of Environmental Conventions and Protocols signed and/or ratified by the Republic of Armenia[5]

	Convention or Protocol, Name and Place	In force	Signed	Ratified	Relevant	Comment
1	**Convention on Wetlands of International Significance especially as Waterfowl Habitat (Ramsar, 1971)**	1975	1993	**Ratified by USSR**	x	
2	**Convention on Biological Diversity (Rio-De-Janeiro, 1992)**	1993	1992	1993	x	**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
7	**Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991)**	1997		1996	x	**Re-registered in UN 1997**
	Protocol on Strategic Environmental Assessment (Kiev, 2003)		2003	2011	x	
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	x	**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

[5] Official web-site of the Ministry of Nature Protection: http://www.nature-ic.am/ccarmenia/en/?nid=365. Accessed in March 2009.

	Convention or Protocol, Name and Place	In force	Signed	Ratified	Relevant	Comment
12	**Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus, 1998)**	2001	1998	2001	x	
13	Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)		1998	2003		
14	**Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)**	1996			x	
	Protocol on Water and Health (London, 1999)		1999		x	
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	x	
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		x	

2.2. World Bank Operational Policies

WB OP 4.01 Environmental Assessment is considered to be the umbrella policy for the Bank's environmental safeguard policies. These policies are critical for ensuring that potentially adverse environmental and social consequences are identified, minimized, and properly mitigated. These policies receive particular attention during the project preparation and approval process. The World Bank carries out screening of each proposed project to determine the appropriate extent and type of EA to be undertaken and whether or not the project may trigger other safeguard policies. The Borrower is responsible for any assessment required by the Safeguard Policies, with general advice provided by the World Bank staff. The safeguard policies and triggers for each policy are presented in the Table 3.3 below.

Table 2.3. **World Bank Safeguard Policies**

Operational Policy	Triggers
Environmental Assessment (OP 4.01)	If a project is likely to have potential (adverse) environmental risks and impacts in its area of influence.
Natural Habitats (OP 4.04)	The policy is triggered by any project with the potential to cause significant conversion (loss) or degradation of natural habitats

Operational Policy	Triggers
	whether directly (through construction) or indirectly (through human activities induced by the project).
Pest Management (OP 4.09)	If procurement of pesticides is envisaged; If the project may affect pest management in the way that harm could be done, even though the project is not envisaged to procure pesticides. This includes projects that may (i) lead to substantially increased pesticide use and subsequent increase in health and environmental risk, (ii) maintain or expand present pest management practices that are unsustainable, not based on an IPM approach, and/or pose significant health or environmental risks.
Physical Cultural Resources (OP 4.11)	The policy is triggered by projects, which, prima facie, entail the risk of damaging cultural property (e.g. any project that includes large scale excavations, movement of earth, surface environmental changes or demolition).
Involuntary Resettlement (OP 4.12)	Physical relocation, land loss or restriction of land use resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location.
Forests (OP 4.36)	Forest sector activities and other Bank sponsored interventions, which have potential to impact significantly upon forested areas.
Safety of Dams (OP 4.37)	If a project involves construction of a large dam (15 m or higher) or a high hazard dam; If a project is dependent upon an existing dam, or dam under construction.
Projects on International Waterways (OP 7.50)	If the project is on international waterway such as: any river, canal, lake, or similar body of water that forms a boundary between, or any river or body of surface water that flows through, two or more states (or any tributary or other body of surface water that is a component of this waterway); any bay, gulf, strait, or channel bounded by two or more states or, if within one state, re-cognized as a necessary channel of communication between the open sea and other states-and any river flowing into such waters.

MRP implementation will have some environmental and social impacts.

The project, therefore, triggers WB OP/BP 4.01 **Environmental Assessment**. Mastara reservoir project requires implementation of ESIA and a positive conclusion from the Environmental Expertise of the Ministry of Nature Protection.

The project triggers WB OP/BP 4.37 **Safety of Dams** as the MRP envisages construction of a dam and reservoir which is a potential danger in case of accidents for both the downstream communities and environment.

MRP also triggers WB OP/BP 7.50 **Projects on International Waterways.** Apart from the waters of Selav Mastara mud flow Akhuryan River, which is a transboundary river with the riparian Turkey, will feed the reservoir with water.

MRP triggers WB OP/BP 4.09 **Pest Management** because some agricultural areas, which had been out of irrigation due to deteriorated infrastructure, will be brought back to irrigation as a result of Mastara reservoir construction which could entail more intensive use of pesticides. While there is no need of developing a Pest Management Plan, promotion of sound pesticide use practices and of the Integrated Pest Management is included into the project design.

MRP also triggers WB OP/BP 4.12 **Involuntary Resettlement** as the construction of the reservoir will require The Project permanently acquire **68.630** ha of land plots according to FSL at 950m design option or **75.303** ha of land according to FSL at 951.5m design option. A Resettlement Action Plan (RAP) is developed for MRP.

2.3. Environmental, Health and Safety Guidelines of IFC

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice. When one or more members of the World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. For complex projects, use of multiple industry-sector guidelines may be necessary.

The General EHS Guidelines contain the following 4 sections of information:

1. Environment: This section contain 8 specific sub-sections with relevant approaches for each of it.
2. Occupational Health and Safety: Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety.
3. Community Health and Safety: This section complements the guidance provided in the preceding environmental and occupational health and safety sections, specifically addressing some aspects of project activities taking place outside of the traditional project boundaries, but nonetheless related to the project operations, as may be applicable on a project basis.
4. Construction and Decommissioning: This section provides additional, specific guidance on prevention and control of community health and safety impacts that may occur during new project development, at the end of the project life-cycle, or due to expansion or modification of existing project facilities.

2.4. Comparison of RA Legislation and World Bank Operational Policies

The requirements of RA environmental legislation, as it pertains to the procedures required for the MRP implementation, are in general comparable to WB policy approaches. However, there are also several differences between local legislation and WB policy requirements, the most tangible of which are summarized below.

In Armenia the ESIA is implemented by the project initiator. It includes environmental and social impacts analyses and mitigation measures. The ESIA is submitted to EIAEE SNCO. The Environmental Expertise is carried out based on the application submitted by the project initiator. During the expert examination phase a decision is made on permission for the project and a conclusion is made for further activities.

While the WB OP/BP 4.01 Environmental Assessment implies ESIA implementation by the project initiator based on the review of the design documents. The assessment includes description of environmental and social impacts by the entity that releases permission for the project.

Both Armenian EIA legislation and WB OP/BP 4.01 require classification of activities into environmental categories A, B, and C. According to this classification MRP is a Category A project.

The national legislation does not provide definition of the ESMP but it requires that ESIA report contain assessment of all possible impacts on environment, the list of mitigation measures, a monitoring plan and their implementation procedures. An ESMP in line with the requirements of OP/BP 4.01 will be developed for MRP.

The national Law on Environmental Impact Assessment and Expert Examination (2014) and the RA Government Decree on Procedure for Organization of Public Outreach and Discussions (2014) is mostly similar to WB requirements with respect to public disclosure of the ESIA documents and includes the requirement of at least 2 public hearings/discussions. Furthermore, RA is a party to Aarhus convention and

ensures availability of environmental information as well as public consultation on the environmental aspects of the proposed projects in line with the principles of this convention.

2.5. Institutional Framework

The roles of the government agencies related to MRP implementation are briefly presented below:

Ministry of Energy Infrastructure and Natural Resources

The Ministry of Energy Infrastructures and Natural Resources (MEINR) is a state body with executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the energy sector. The ministry is also responsible for the protection, sustainable use, and regeneration of natural resources, and implements its functions through the Agency of Mineral Resource and the Subsoil Concession Agency.

The State Committee of Water Economy

The State Committee of Water Economy (SCWE) under the MEINR has a mandate of improving the management of companies engaged in water activities. Amongst other objectives, the SCWE promotes improvement of water services to the consumers and implementation of further reforms in the water infrastructure and service delivery. SCWE has the following functions: participation in the development and implementation of the National Water Policy and Water National Program of the RA; submission to the RA Government annual reports on water use by a breakdown of sources and user companies; authorized management of state shares in companies engaged in commercial activities, such as construction of hydro-technical structures, technical operation, water supply and sewerage services in the areas of irrigation, drinking water, sewerage as well as in state entities which implement investment projects in natural and artificial water basins in the above mentioned areas with foreign funding.

This is actually the key Ministry in the frame of which the State authorized entity is acting for water economy sphere and the PIU acting under it, is the responsible institution for the MRP. After the construction of the reservoir it would be handed over to the State Committee of Water Economy, which will perform the commissioning of the reservoir through an institution (most probably it Water Supply Agency) acting within its system.

Ministry of Nature Protection

The Ministry of Nature Protection (MNP) 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 MNP authority includes overseeing national policy development, developing environmental standards and guidelines, and enforcement.

Ministry of Territorial Administration and Development

The Ministry of Territorial Administration and Development elaborates and implements the policies of the Republic of Armenia Government in the area of territorial administration and local self-governance bodies. Marzpetarans (regional administration bodies) are responsible for administration of public infrastructure falling under the regional jurisdiction. The activities of local authorities with whom the project closely collaborates are coordinated by Marzpetarans (regional municipalities) and this ministry. Since eight communities are affected and beneficiary communities of MRP, the Ministry, as the state authorized entity to coordinate the community works in the future, may be involved in the project implementation.

Ministry of Emergency Situations

Armenian State Hydro-meteorological and Monitoring Service SNCO is among the structural entities acting within the Ministry of Emergency Situations and conducts regular monitoring of meteorological and hydrological conditions of Armenia through its network of meteorological and hydrological stations and posts.

Ministry of Agriculture

The Ministry of Agriculture with its Melioration Development Department is responsible for the development, implementation and coordination of annual projects on construction, operation, rehabilitation and cleaning of collector-drainage systems.

Ministry of Health

The State Health Inspectorate within the structure of the Ministry of Health is responsible for coordination of all issues related to health (including those on noise and vibration) and for supervision over implementation of sanitary norms, hygienic and anti-epidemiological measures implementation by organizations and citizens. The institutions acting under this Ministry shall control or conduct regular inspections on the sanitations, healthcare of the employees and provision of safe work space at the construction sites.

Ministry of Labor and Social Issues

The Ministry of Labor and Social Issues among other things is responsible for development and implementation of the state policy, legislation and programs in the following areas: social security, labor and employment, social assistance, social assistance to disabled and aged people, social protection of families, women and children, etc. As the state authorized body responsible for the labor regulations and social affairs, this Ministry would possibly deal with MRP since some construction companies and also the company responsible for the operation of the reservoir should follow Labor Code and labor relations as employers.

3. ENVIRONMENTAL AND SOCIAL ASSESSMENT METHODOLOGY

The present ESIA was carried out in accordance with the Terms of Reference agreed upon with the WB . It covered the entire scope of the Project, including construction and operation phases of the MRP. The ESIA process included desk work to review project documents and scientific literature, as well as field work aimed at verification of the available data, collection of missing information, and meetings with the Project stakeholders. The aim of the meeting was to assess existing social issues and reveal expected social impacts. The collection of baseline data in Project site and adjacent areas, as well as the photos are part of it.

3.1. Environmental Examination and Assessment Methods

The botanist, zoologist and water ecosystem specialist of the ESIA team have explored the area envisaged for the reservoir and have conducted visual observation of the sites.

The examinations were conducted with the classical field study methods: route study and desk study methods. Herbarium collections of some vegetation species was done, shots of plants and animals as well as their nets were taken.

The study of the collected samples and their identification was implemented in the office conditions. The identification of the species and the verification of their names were done through 11 volumes of Armenian Flora (1954-2010), a series of additional, professional literature was used. The team clarified the status of rare and endemic plants and animals according to the Red Book and the criteria developed by the commission of International Union for Conservation of Nature and Natural Resources.

The topsoil study was conducted through both desk study and on-site studt through description of soil layer cut and analysis of samples.

Based on the collected data the Consultant has defined the sensitive environmental components and has assessed possible environmental and social impacts for both the construction and operation stages of the reservoir.

The team reviewed the solutions of the preliminary design, identified the impact indicators related to the designed works based on which the impacts on the environment and the neighboring people were assessed.

The method for assessing a project's impacts on the environment includes identification, prediction (e.g. duration, intensity, severity) and evaluation of the significance of impacts based on legal requirements. The focus of the used evaluation procedure is to decide whether the Project is likely to cause significant adverse environmental effects resulting from the construction and operation.

For the purpose of a transparent presentation and evaluation, a tabulated evaluation matrix is applied. On the basis of a scale (low, medium, high), the severity of the particular environmental impact together with its general trend - that is negative or positive - is described.

The evaluation scale applied is as follows:

Extent of Impact
Hight = International and national standards are exceeded
Medium = Between international and national standards, international and national standards are barely met
Low = International and national standards are met
No impact
Positive

This method clarifies which environmental impacts are most important and for which impacts mitigation measures must be applied in order to reduce negative environmental and social effects.

The team calculated the cost estimates of the impacts and the economic damage size.

Detailed ESMP was developed as a result of certain classification of actions which carry different environmental and social risks and mitigation measures directed to reduce them. The foreseen expenses were calculated for the most important mitigation measures so as to include them in the summary of construction works.

3.2. Social Study Methods

At the feasibility stage of MRP, the ESIA Consultant conducted social studies including qualitative surveys and social-economic analysis to assess social impact in the affected and beneficiary communities. The aim of the qualitative surveys was to identify and discuss irrigation related issues of the communities and to reveal concerns and needs of different groups in the communities, and their expectations from the reservoir construction project.

The Consultant conducted the following studies and works within the frames of the social impact assessment (SIA):

- Study of the existing demographic and social-economic data and available information about Dalarik, Lernagog, Myasnikyan, Khanjyan, Lukashin, Hatsik. Norapat and Noravan communities from NSS and Armavir marzpetaran (Governor's office) websites,
- In-dept interviews with the mayors of all affected and beneficiary communities as well as with the representatives of "Shenik", "Talin" and "Armavir" WUAs so as with the help of qualitataive studies to identify irrigation related concerns of the communities and the possible negative impact of the project on the communities,
- 16 FG discussions segregated by gender for male and female community members with participation of national minorities and vulnerable groups representatives (HHs registered in family/social benefit system and women headed HHs) in all affected and beneficiary communities: Myasnikyan, Khanjyan, Lukashin, Hatsik, Norapat and Noravan to reveal the concerns and needs of the groups and their expectations from the reservoir construction project,
- Formation of Stakeholder Proactive Groups in each community identified during the community meetings and group discussions. They participated in all meetings and the presentation of the design solutions; they will support the project to better understand the existing needs of their communities, reveal conflicts between different stakeholders (if there are such conflicts or risks) at early stage of the design works and inform local population of temporary employment opportunities, etc.)
- Identification and assessment of the volume of the project's posible negative impact based on the social-economic studies and analysis, as well as the results of direct communication with the local population.

4. PROJECT DESCRIPTION

4.1. Project Objective

Agriculture is a prevailing aspect in the economics of Armenia. It ensures different levels of industrial occupation for about half of households and form 20% of GDP.

Availability of guarranteed volumes of low cost irrigation water has essential significance for reinforcement and development of agriculture. It will contribute to enhanced production of agricultural goods and increased incomes in rural population.

The best way to achieve these results is to collect irrigation waters. Therefore, it is envisaged to construct Mastara reservoir and to fill it with free flows of Selav Mastara River; based on observations maximum flow is 8.26mln m^3 and the minimum is 5.36mln m^3. The remaining volume will be added from Akhuryan River during II,III, IV and XI non-irrigation months of the year using free flood flows from the section from Akhuryan reservoir to Talin irrigation intake point when the flow is not used for irrigation purposes.

The Mastara reservoir project envisages to enhance irrigation water demand shortage in 6 communities of in Armavir Marz and to extend fertile lands of Ararat Valley by increasing irrigated lands with 675 ha of non-cultivated land. The Project will make it possible to provide gravity irrigation water to those areas of beneficiary communities that use pumped water (from deep wells) saving on operation expenses and the energy.

The construction of the reservoir is aimed for subsidiary water conveyance to Armavir main canal to improve irrigation in 6 communities of RA Armavir Marz (Province) – Hatsik (1,081ha), Myasnikyan (836 ha), Khanjyan (533.5 ha), Lukashin (689.4 ha), Norapat (252.9 ha) and Noravan (315.6 ha). In 2017 the total irrigated area in these communities was 3,708 ha of land. With the construction of the reservoir additional 675 ha of land will be irrigated in Hatsik (h are currently non-irrigated arable lands (for details see Book 2, Section A and B).

On the whole there is a need to provide water to 4,384 ha of land. These communities are annually supplied with 18.2mln m^3 irrigation water (2013-2016) out of which 2.31mln m^3 from deep wells and 0.33mln m^3 from pumping stations, however, there is a need for additional 6.9mln m^3 irrigation water to cover the entire demand (netto volumes are presented).

The MRP envisages the following outcomes:

- Provision of guaranteed irrigation water volumes with low cost,
- Energy savings (about 1.9mln. kwt/h) as a result of stopping the use of deep wells and reduction in maintenance expenses through conversion of irrigation from mechanical to gravity,
- Regulation of Selav Mastara River flow and avoiding adverse consequences of floods, significant decrease or elimination of destructions of downstream adjacent areas,
- Extension of irrigated areas and improved agricultural production.

4.2. Planned Construction Works

The project envisages to build:

- Dam
- Reservoir ground structures
- Diversion pipeline downstream the reservoir
- Alternative road.

It is envisaged to cover downstream surface of the rock filled dam, with the volume of 1.2mln m^3, with geomembrane. The body of the dam will be rock filled, transition materials and concrete; geomembrane will be used for top layer.

The reservoir will have hydraulic structures as Diversion System, Spillway and Water intake.

The multi-purposed concrete culvert will be built in the river bed; it will be equipped with bottom outlet concrete entrance and with water intake tower. The service valve room will be built in the end of culvert

before stilling basin. The stilling basin will be built in the end of culvert, and the water supply pipe will be branched from this part.

A free ogee spillway will be built in the left abutment, with160m chute length and 24m width. The energy Dissipater will be as a flip bucket with 10m radius.

In order to provide irrigation water to the communities it is envisaged to build a pipeline branched from the left part of the stilling basin. The length of the pipeline will be 4,750m with D=900mm.

Below is the detailed list and parameters of structures to be constructed as part of the project:

Item	Description
Dam	
Type	A rock fill dam with geomembrane upstream surface with about 1.2M m^3 volume. The dam body will consist of rock fill transition materials and concrete bed for geomembrane cover.
Crest Width	8.0m
Crest Length	1100.0m
Fetch Length	770.0m
Normal Wave Freeboard	0.97m
Normal water level	951.5 m.a.s.l.
Crest level	954.5 m.a.s.l.
Diversion System	
Type	Cut and cover concrete culvert
Design flood return period	20-years
Design peak discharge	56.7m^3/sec
Conduit Type	Horse Shoe Culvert
Culvert Diameter	4m (height and width)
Culvert Length	105m
Culvert Slope	1%
Culvert Entrance Ele.	928 masl
Upstream Cofferdam Height	5.5m
Down Cofferdam Height	2.0m
Bottom Outlet	
Intake Entrance Ele.	935masl
Trashrack Dimension	2.7×2.2m (w×h)
Head Gate Bulkhead	1.6×1.6m
Transmission Conduit Pipe	900mm
Conduit Length	87m
Guard Gate Bonneted Slide	800×800mm
Service Gate Bonneted Slide	600×600mm
Discharge Capacity	5.8 m3/sec
Reservoir Evacuation Time	14.7 days
Stilling Basin Type	II USBR
Stilling Basin Width	6.0m
Stilling Basin Length	8.0m
Irrigation Intake	
Intake Entrance Ele.	935masl
Trashrack Dimension	2×1.2×1.6+2×1.6m (w×h)
Head Gate Bulkhead	1.2×1.2m
Transmission Conduit Pipe	1200mm
Conduit Length	113m
Guard Valve Butterfly	1200mm
Service Gate Howell Bunger	800mm

Discharge Capacity	3.9cm/sec
Spillway	
Design Flood	100 yrs 135cm/sec
Control Flood	1000 yrs 265cm/sec
Spillway Net Width	24m
Normal Water Level	951.5m asl
Design Level	953.1m asl
Control Level	954m asl
Chute Start Width	26.0m
Chute End Width	10.0m
Chute Length	146.0m
Energy Dissipator	Flip Bucket with 10m Radius
Jet Impact Length	23.0m
Jet Scour	8.0m
Diversion pipeline downstream the reservoir	
Length	4550 m
Diameter	900 mm
Discharge Capacity	1.3cm/sec
Alternative road	
Lenght	1520m
Width	6.8m
Type	Asphalt road, to be constructed on the right bank above the dam crest level

5. ANALYSIS OF ALTERNATIVES

The alternative versions of the project are viewed from two points. The first is with "No Action" version i.e. the envisaged Project is not implemented. The next is the Project implementation with several alternative options.

5.1. "No Action" Option

"No Action" option is for the situation when Mastara reservoir is not built. With this scenario no construction is implemented and no construction impacts occur: such as dust burnt fuel emissions, noise, traffic, etc.

The existing irrigation scheme will be used which is not capable of ensuring the required volume of irrigation water, no additional employment opportunities will be created, the regional infrastructures will not be extended.

5.2. Mastara Reservoir Dam and Adjacent Structures

As a result of investigations carried out by the Implementation Consultant and the discussions with the Client it is proposed to design Mastara reservoir with a volume of 7.5 million cubic meter (in the result of construction) and with a water yield of 11.9 million cubic meter.

Dam Type Selection

Selection of the dam type was based on several factors, such as biophysical environment of the site, geology of the area, availability of construction materials and associated costs. Compariston was made between the following dam types which had been found generally reasonable:

- *Earthfill dam with clay core*
- *Rockfill dam with clay core*
- *Rockfill dam with concrete cover*
- *Rockfill dam with geomembrane cover*
- *Concrete dam condensed with roller*

Earthfill dam with clay core

Earthfill dams are made up mostly of compacted earth. Most embankment dams have a zone in the middle, called the core, made of low permeability material, a permeable part growing gradually outward called a filter on the two sides covering the core, and the shell on the upstream and downstream heels. The core is usually made of clayey soils to stop water passing through the dam. Earthfill dams are the least expensive type of dam to build, are made of clay and compacted earth, and are relatively small and easily eroded. Earthfill dam designs have to solve four problems of structure and foundation: mechanical stability, imperviousness, internal erosion, and external erosion.

The advantages of the earthfill dam include the following: wide earth core and filters provides safe dam earthquake resistance; earth core design most economic if suitable borrow areas are within reasonable transportation distances; and earthfill dam have been used for many years and the efficiency of this type of dam is well documented. Some of the cons are as follows: difficult to construct in rainy weather; largest quantity of fill required; foundation treatment in the core zone to avoid erosion of the core material along the fractured rock surface; more vulnerable to overtopping during construction; and continuous maintenance (such as vegetation control) required.

Rockfill dam with clay core

Rockfill dams are mainly made from dumped and compacted rock fill. New solutions and equipment for drilling and blasting in quarries considerably reduced costs. Spreading rockfill in the dam body in layers 0.50 or 1m thick and compacting it with heavy equipment improved the mechanical qualities of dams and reduced settlement to very low figures. Another advantage of rockfill is possibility it offers of working in very cold or rainy conditions. Rockfill dams are permeable. They have an impermeable core or an impermeable layer on the upstream face of the dam to prevent seepage through the porous core. The impermeable parts are usually made of reinforced concrete, asphaltic concrete or clay. Better mechanical qualities allow steeper

external slopes and reduced quantities and save costs overall. A large part of rockfill dams use designs similar to the high earthfill dams. Rockfill dams are constructed from materials from the reservoir site.

Rockfill dam with concrete cover

After 1970, the improved quality of rockfill has favored the development of a very cost-effective type of medium and high dam, the Concrete Faced Rockfill Dam, which also applies to dams well over 100m. The whole dam body is in rockfill; construction is thus easier than with the traditional earth core rockfill dam. Imperviousness is insured by an upstream reinforced concrete lining. The lack of rockfill settlement and the careful design and construction of reinforced concrete slabs insure the good quality and imperviousness of such dams. However, the main risk for rockfill dams remains the possibility of overtopping caused by exceptionally high floods, as dams can be fully destroyed by a water nappe depth of 1m over the crest. Slab thickness and reinforcing requirements have usually been determined by experience or precedent, with the goal of satisfying the following criteria: low permeability, high resistance to weathering action, sufficient strength to bridge subsided areas of the face and sufficient slab articulation to tolerate embankment settlements.

The advantages of the rockfill dam with concrete cover include the following: slope protection against waves and ice; rockfill zone is unsaturated and slopes can be constructed steeper that earth fill dams; plinth and grouting can take place independently of the other dam construction. The cons are leakage through opened joints and tension cracks; large compression cracks occurring in high dam`s in narrow valleys; and inability to provide storage during construction.

Rockfill dam with geomembrane cover

In order to seal the upstream side of the rockfill dam, thin diaphragm of impermeable material is provided to form the water barrier. The advantages of the rockfill dam with geomembrane cover include the following: rockfill zone is unsaturated and downstream slope can be constructed steeper than earthfill dams; plinth and grouting can take place independently of the other dam construction; membrane flexibility to accommodate rockfill deformations; have the disadvantage of being readily available for inspection or emergency repair if they are ruptured due to a material flaw or settlement of the dam or its foundation. The cons of this dam are vulnerability to impacts, ice loads, sabotage, effects of weathering and aging; need for a partial or fully covered protective layer that increases cost; and inability to provide storage during construction.

Concrete dam condensed with roller

This type of dam construction has the advantage of being better adapted to weaker rock foundations (or even to soft foundations for low dams), to heavy earthquakes, and to any extra load due to unforeseen floods. Concrete dams are best suited for in-channel overflow structures, as well as narrow gorges. They are less susceptible to erosion, rely on the weight of the structure and/or the strength of the bond or anchor at the abutments and require solid impervious strata for an adequate foundation (extensive geotechnical investigation is critical). The main advantages are overtopping protection and the smallest dam volume. The concrete dams are the most expensive.

At the detailed design phase it is recommended to use the rockfill dam covered with geomembrane layer as well as to consider the use of geomembrane to ensure non-permeability of reservoir that will result in imporved technical-economic characteristics. Ensuring water non-permeability of the reservoir and the dam by using geomembrane layer is a long-term solution for the water loss problems. It is important to ensure careful design and implementation of the geomembrane placement on the ground considering optimal slops and smooth base as well as to ensure implementation of technical measures of its protection.

Analysis

Fill dams tend to be perceived as more environmentally friendly because they are made of earth materials and blend into the scenery better than monolithic concrete structures. Fill dams have proven useful and less expensive solutions to meeting human needs for water supply, and vast improvements in engineering technology have improved their safety record in the late twentieth century. Increasingly, fill dams also include geotextiles and geomembranes. Geotextiles are nonwoven fabrics that are strong and puncture-

resistant. They can be placed between lifts as the dam is raised to strength weak materials. They are also used as filter fabrics to wrap coarser drain rock and limit the migration of fine soil into the drainage material. Geomembranes are made of high-density polyethylene (HDPE) plastic and are impermeable. They can be used to line the upstream face of a fill dam or even to line the entire reservoir. ***Hence, the first choice, based on lower cost and environmental friendliness, was made in favor of a fill dam type.***

Further on, to ensure low permeability of the dam, ***rockfill dam option with geomembrane cover was picked***. The selected alternative will minimize water losses and support the sustainable use of water resources.

During the first stage of the preliminary design, the Consultant submitted the reservoir construction design with FSL 950m and the dam height of 27m. Later, upon request of the Client, the Consultant prepared the option of FSL at 951.5m (dam height 28.5 m). The construction cost and the required volume of investments for the construction of the second option are higher, however, it will collect more water ensuring reliable water supply service.

From environmental viewpoint, the second option's negative impact is bigger due to larger surface of the reservoir and required lands. In particular, the land required for the first option of the reservoir is 68.630ha while for the second option, the required land is 75.303ha. However, considering the fact that the area is practically deprived of vegetative layer and fertile soil layer, it is not used for agriculture, the difference in the surface area will not create significant environmental or social negative impact while the efficiency of the water supply scheme will increase.

The current diversion pipeline and alternative road preliminary routes are selected as environmentally and socially preferred alternatives. However, during the detailed design phase, expert inspection of selected routes should be conducted to clarify protection priorities.

In any case, all positive and negative impacts will be considered during final decision-making process.

6. ENVIRONMENTAL BASELINE DATA

6.1. Relief and Geomorphology, Physical-Geographical Conditions

Mastara reservoir is located in the RA Armavir Marz, at south-western feet of Mount Aragats, between communities Myasnikyan and Dalarik. The dam will be built on north-western boundaries of Myasnikyan community and the reservoir will occupy territories of Dalarik and Lernagog communities.

The main peak of this area is Mount Aragats. The northern peak of the mountain is the highest point in Armenia with the height of 4,090m. Mount Aragats is a separate rocky mountain spread like a shield with a circle of about 200km. Together with its slopes it occupies about 4,000km surface between Ararat and Shirak valleys, Akhuryan and Kasakh Rivers. The neighboring mountains from three sides are Mount Shara from the North, Mount Ara from the East and Mount Mets Arteni from the South-West.

The water basin of Selav Mastara River is formed on plateaus of Karmrashen and Talin on southern slopes of Mount Aragats. Karmrashen plateau is located at south-western slop of Mount Aragats between Akhuryan and Araks Rivers. Gradually descending on south-eastern direction it reconciles with Ararat valley. It is composed of Neogene and Pleistocene volcanic rocks. The surface is slightly fragmented with wavy hills. There are lava flows, slag cones with relative height of 100m. The important morphological elements of the surface are gullies of Mastara mud flow system.

Physical-Geographical Regions and Upward Landscape Zones, Geoecological Circling

With the physical-geographical regions and natural landscape zones Mastara reservoir area is located in the middle Araks Province (IV) Ararat region (18) Armavir-Artashat (18a) subregion.

Among the *ascending landscape zones* the region mostly occupies *semi-desert mountainous plateau* (500-1000m) and *dry steppe low mountainous zone* (1000-1600m) (National Atlas of Armenia, Volume A, page 86).

With *geoecological circling* the mineralization field area is located in Araks River basin province (II), Ararat region (IV), Armavir-Artashat (16) subregion.

The *natural landscape vulnerability coefficient* for ascending landscape zone of Mastara reservoir is as follows: the *natural landscape vulnerability coefficient* for *semi-desert mountainous plateau* (500-1000m) and *dry steppe low mountainous zone* (1000-1600m) is estimated with 0,8-1,0 value (very strong vulnerability). The main reason is the depth of urbanization, intensive use of the ground cover for agricultural purposes, operation of non-metallic mines, littering of soil with communal and construction waste.

Relief and Geomorphology

The relief of the reservoir area is diverse. The right bank of the river can be characterized with rugged slops of the river, composed of accumulative (sedimentary, spatial) alluvial-prolevial sediments. The lands of the right bank of the river that are in the reservoir footprint are covered with the mud flow sediments. The relief here has been partially deteriorated during the construction of the road and railway. The right bank slope, the relief adjacent to the dam, is gradually descending to the river bank.

The left bank of Selav Mastara River is characterized with an erosional volcanic relief on a slightly corrugated base. The flow of volcanic rocks have created wavy terrain, hillsides, on tops of which the outbreaks of the original rocks can be seen. In the result of storms the relief shape here became mild, plain gorges slightly inclined to the riverbed. The left bank relief has comparatively small anthropogenic influence.

At the entrance of Mastara reservoir the river has created a narrow but not deep gorge. On the whole the left bank is higher than the right bank. At some spots there are bare volcanic and sediment rock layers in the gorge of the river.

Picture 6.1. Bare volcanic rock layers on Mastara River bank

Mudflows and Landslides

Mudflows has had huge impact on regional relief.

Spring floods have an immense damage to agriculture, residential areas and environment. In Metsamor basin the most notable mudflows from Aragats are Mastara and Talin mudflows which are repeated every 2-3 years.

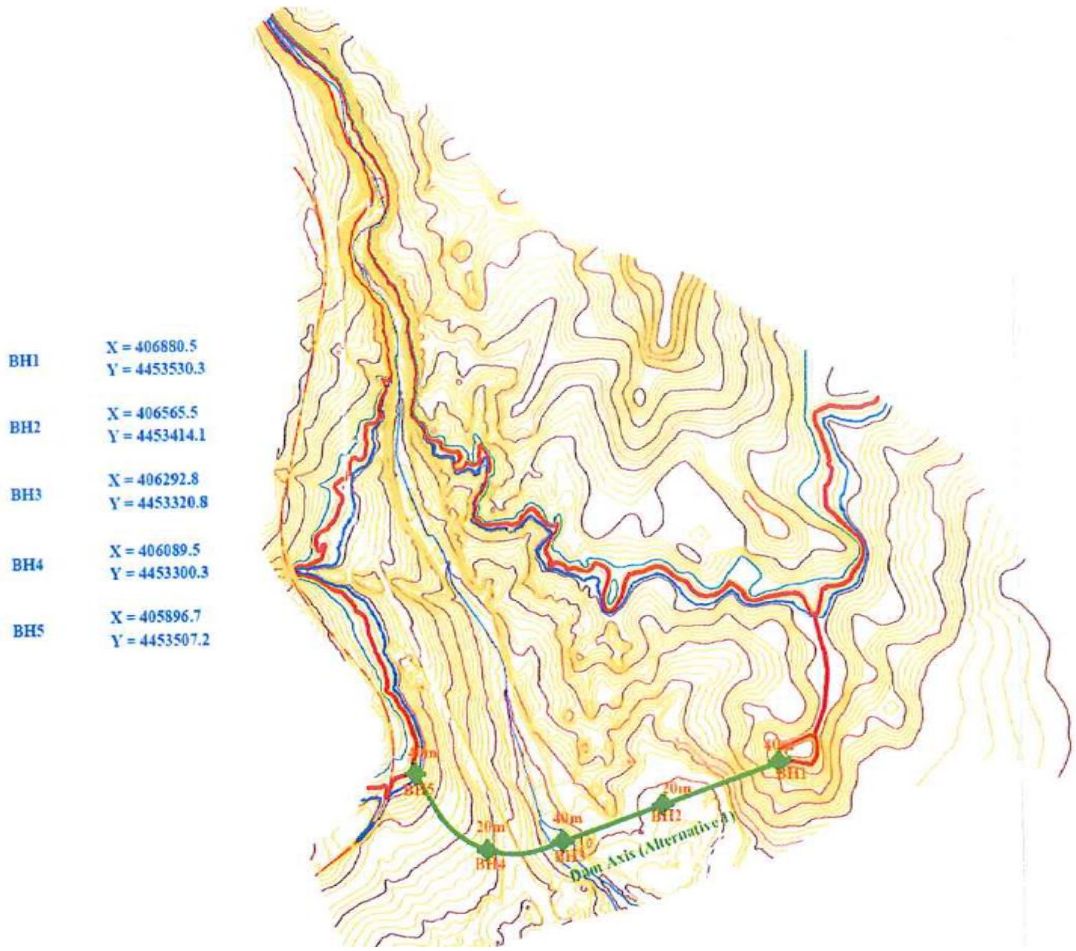
Mastara mudflows mostly occur as a result of spring and summer showers and rarely as a result of snowmelt. The mudflow exits sometimes reach 165-170m^3/s. In this basin there are other mudflow rivers as well: Selav-Shamiram, Kalakut, Selav-Getap which flow into Mastara.

In Metsanor basin, including Mastara basin there are very few landslides.

Geology

The polygene volcano of Mount Aragats has had a definite impact on the structure earth's crust outer layer in Mastara reservoir’s area.

New volcanism is typical to the region. The region is surrounded by numerous small monogenic volcanos, mostly by shaft cones.



Picture 6.2. Mastara reservoir schematic map

6.2. Climate Conditions

The main characteristics of the atmosphere in the reservoir area including air pollution have been analyzed as well as the envisaged impact on the atmosphere and the foreseen changes after the reservoir construction have been assessed.

The climate of the reservoir and the adjacent areas is presented by the data from Armavir, Talin and Qarakert observations and some estimations. The most important issue is what kind of changes the meteor-elements will undergo after the reservoir construction. Those changes are conditioned by microclimate change which will impact both the environment and social-economic characteristics of the area. It is anticipated that during the reservoir construction there will be short-term small-scale and locally restricted unfavorable impact on environment.

Air temperature: Among the main factors of climate formation at Mastara reservoir and its vicinity are radiation mode, relief shapes, height of the site, geographical latitude, day and night periods, nature of floating surface, etc.

The climate conditions of the area are hot and dry. Dry, severe continental climate is typical for lowlands up to 1,000m of height, while dry continental climate with cold winters is typical to highlands 1,000-1,300m of height.

The annual average temperature of the air is 11.6^{0}C in Armavir, 8^{0}C in Talin and 11^{0}C in Qarakert (Table 7.1).

The tables present absolute values for maximum and minimum temperature. In the reservoir area the temperatures according to Qarakert data are 15^{0}C and -28^{0}C in January, 40^{0}C and 8^{0}C in July.

Table 6.1. Monthly and annual temperature of air (^{0}C)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	-4.2	-1.6	4.9	12.4	17.4	21.6	25.7	25.1	20.0	12.9	5.7	-0.9	11.6
Qarakert	-4.2	-2.6	3.7	11.1	16.1	20.4	24.7	24.5	19.9	13.4	5.8	-0.9	11.0
Talin	-5.2	-4.0	0.6	7.6	12.1	16.4	20.7	20.8	16.5	10.1	3.3	-2.9	8.0

Table 6.2. Air temperature at different hours of the day (^{0}C)

Observation hour	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Armavir												
00	-5.5	-2.9	3.2	10.2	14.2	18.4	22.5	21.8	16.5	9.7	3.4	-1.8
03	-6.2	-4.3	1.7	8.3	12.2	16.0	19.8	19.1	14.0	7.9	2.1	-2.5
06	-6.8	-5.0	0.6	6.9	11.3	15.3	18.5	17.2	11.9	6.3	1.2	-3.1
09	-5.5	-3.0	4.9	12.7	17.6	22.1	25.8	25.2	20.4	12.9	4.7	-1.8
12	-0.6	2.2	9.3	16.6	21.2	26.2	30.0	29.5	25.4	17.9	10.2	2.7
15	1.1	3.9	11.0	18.2	22.5	27.9	32.1	31.6	27.5	19.6	11.6	4.0
18	-2.0	1.4	9.2	16.6	20.8	26.2	30.7	29.9	24.6	15.7	7.7	1.1
21	-4.4	-1.9	5.2	12.6	16.7	21.3	25.7	24.9	19.1	11.7	4.9	-0.8
Talin												
00	-6.7	-5.7	-0.7	5.4	9.4	13.1	17.5	17.8	13.9	7.7	1.6	-4.1
03	-7.4	-6.5	-1.5	4.4	8.5	11.9	16.0	16.3	12.5	6.6	1.0	-4.9
06	-7.1	-6.3	-1.7	4.2	9.2	13.2	16.5	16.2	12.3	6.7	1.1	-4.6
09	-5.7	-4.1	1.2	7.9	13.0	17.4	21.2	21.3	17.4	11.0	4.2	-3.0
12	-2.9	-1.7	3.3	10.2	15.0	20.1	24.5	24.5	20.4	13.2	6.2	-0.6
15	-2.4	-0.9	4.4	11.3	15.7	21.2	26.2	26.4	22.1	14.3	6.8	-0.3
18	-4.9	-3.3	2.6	9.9	14.0	19.4	24.4	24.4	19.6	11.3	3.8	-2.6
21	-6.0	-5.1	0.2	6.7	10.6	14.7	19.6	20.0	15.8	8.9	2.5	-3.5
Observation hour	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII

Table 6.3. Average maximum temperature of air (^{0}C)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	1.3	4.3	11.5	19.3	24.4	29.2	33.2	32.9	28.4	20.8	12.4	4.4	18.5
Qarakert	*0.4*	*2.5*	*9.3*	*17.2*	*22.3*	*27.4*	*31.7*	*31.6*	*26.9*	*19.2*	*10.8*	*3.4*	*16.9*
Talin	-1.6	0.0	5.1	12.4	17.7	22.6	27.3	27.4	22.8	15.3	7.5	0.9	13.1

Table 6.4. Average minimum temperature of air (^{0}C))

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	-8.6	-6.5	-0.8	5.8	10.5	14.1	17.7	16.8	11.5	5.6	0.5	-4.9	5.1
Qarakert	*-7.8*	*-6.7*	*-0.8*	*5.7*	*10.5*	*14.5*	*17.9*	*17.9*	*13.6*	*8.0*	*1.9*	*-4.2*	*5.9*
Talin	-9.3	-7.8	-3.4	2.9	7.1	10.4	14.2	14.5	10.5	5.1	-0.4	-6.2	3.1

Table 6.5. Absolute maximum temperature of air (^{0}C)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	18	21	26	33	35	39	41	41	38	35	25	20	41
Qarakert	*15*	*19*	*25*	*29*	*33*	*37*	*40*	*39*	*37*	*32*	*23*	*17*	*40*
Talin	*13.1*	*15.0*	*20.1*	*25.8*	*33.0*	*32.3*	*37.5*	*36.1*	*35.6*	*27.8*	*23.4*	*13.6*	*37.5*

Table 6.6. Absolute minimum temperature of air (^{0}C)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	-31	-31	-23	-10	0	3	7	7	-2	-7	-17	-30	-31
Qarakert	*-28*	*-28*	*-21*	*-8*	*0*	*3*	*8*	*9*	*2*	*-4*	*-16*	*-25*	*-28*
Talin	-26.1	-23.2	-21.1	-14.6	-3.2	-0.5	3.4	5.0	-0.2	-9.3	-18.2	-25.3	-26.1

The temperature drops below 0^{0}C, i.e. the start of winter is December 10 and it grows above 0^{0}C, i.e. the start of spring is February 24. The number of “no frost” days is 204 days on average (Table 7.7).As a rule the late spring freezing of air is the first decade of April and the early fall freezing is the end of October:

Table 6.7. First and last air freezing periods and no frost periods

Observation Post	Last Frost			First Frost			No Frost Periods (day)		
	average	earliest	latest	average	earliest	latest	average	earliest	latest
Armavir	6 IV	17 III	29 IV	28 X	14 IX	24 XI	204	146	240
Talin	20 IV	19 III	5 VI	29 X	26 IX	2 XII	191	149	238

Ground temperature: The soil temperature is conditioned with a number of factors: precipitation, cloudiness, vegetation and snow layer. Soil composition, humidity, height, location, ground waters, etc. Also have essential role.

Table 6.8. Soil surface temperature (^{0}C)

Characteristics	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Talin													
average	-7	-5	1	9	15	21	26	26	20	10	3	-4	10
average maximum	2	5	14	27	35	44	51	50	43	27	14	5	26
average minimum	-10	-11	-5	0	5	8	12	11	7	2	-3	-9	1
absolute maximum	20	30	40	51	59	64	66	66	62	48	33	22	66
absolute minimum	-31	-32	-24	-12	-7	-3	4	3	-6	-10	-22	-25	-32
Armavir													
average	-4	-2	7	15	21	28	33	31	24	14	5	-1	14
average maximum	6	11	24	37	44	54	60	58	49	34	20	9	34
average minimum	-11	-9	-3	3	8	12	15	14	9	3	-2	-6	3
absolute maximum	25	34	48	59	70	71	70	72	66	55	44	28	72
absolute minimum	-32	-31	-17	-14	-4	0	5	6	-3	-11	-18	-29	-32

The average, the earliest, the latest periods of the first and the last frosts at the ground surface and the “no frost” period according to Armavir and Talin meteorological stations data estimates results are presented in Table 6.9.

Table 6.9. First and last ground surface freezing periods and no frost periods

Observation Post	Last Frost			First Frost			No Frost Periods (day)		
	average	earliest	latest	average	earliest	latest	average	earliest	latest
Armavir	18 IV	23 III	10 V	13 X	14 IX	4 XI	177	142	213
Talin	11 V	13 IV	13 VI	7 X	13 IX	3 XI	148	121	203

Humidity. Humidity is influenced by warm and cold air mass penetrations which can possess other thermic and humidity characteristics as well. The absolute humidity data from Armavir and Talin meteorological stations are presented in Table 6.10 and 6.11.

Table 6.10. Average monthly and annual water vapor elasticity (hPa)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	3.6	4.1	5.4	7.9	10.6	12.3	14.6	14.6	11.6	9.1	6.8	4.8	8.8
Talin	3.3	3.6	4.5	6.4	8.9	10.7	12.5	12.3	9.6	7.4	5.6	3.9	7.4

Table 6.11. Average monthly and annual relative humidity of the air (%)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	76	72	62	56	57	51	48	49	53	65	74	78	62
Qarakert	71	64	61	57	52	50	45	43	46	54	66	72	57
Talin	76	75	68	64	67	61	56	55	55	64	72	77	66

Evaporation. The origin of many processes taking place in the atmosphere is evaporation, which occurs from the seas and oceans, rivers and lakes, moist soil and vegetation.

Table 6.12 shows the monthly values of the evaporation of Armavir and Talin.

Table 6.12 Cumulative evaporation, (mm)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	10	15	25	41	56	58	52	49	42	36	21	11	416
Talin	8	10	18	36	53	58	55	49	42	32	19	10	390

Evaporation values in the reservoir area can be taken by the average arithmetic values of the evaporation values in Armavir and Talin. It is 400mm annually.

The steam capacity is 1,050 mm in Armavir, 897 mm in Talin. Monthly maximum is in July, in Armavir - 156 mm, in Talin - 166 mm (Table 7.13).

Table 6.13 Steaming Capacity: (mm)

Observation Post	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	40	50	62	87	119	141	156	155	112	65	33	30	1050
Talin	13	15	45	77	113	141	166	155	112	58	30	17	897

Cloudiness: Its distribution in the country is disproportionate. The general peculiarity in the country is the following: in the warmer half the ascending clouds prevail. In the warmer half of the year, the maximum number of clouds is observed in the second half of the day and in the evening hours. During the year, the number of cloudless days in Armavir is 92.1, the number of cloudy days is 78.6.

Table 6.14 Number of cloudless and cloudy days as per general cloudiness

Days	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Cloudless	4.5	4.4	5.0	2.9	2.5	8.5	13.0	15.0	15.5	10.5	6.2	4.1	92.1
Cloudy	11.9	10.4	10.2	9.2	7.6	2.7	1.1	0.7	1.3	4.6	7.7	11.2	78.6

Atmospheric precipitation: In Armenia there is a vivid connection between precipitation quantity and the height of the site. Precipitation has a vivid seasonal nature. Maximum level of precipitation is observed in April-June 1st half, and less vivid in October (Table 7.15). The annual level of precipitation in Qarakert is 270mm, in Armavir 260mm, in Talin 438mm. Maximum quantity of precipitation is observed in IV-VI months 715mm, in lowlands 660mm and in highlands 845mm.

Table 6.15 Average quantity of monthly and annual precipitation (mm)

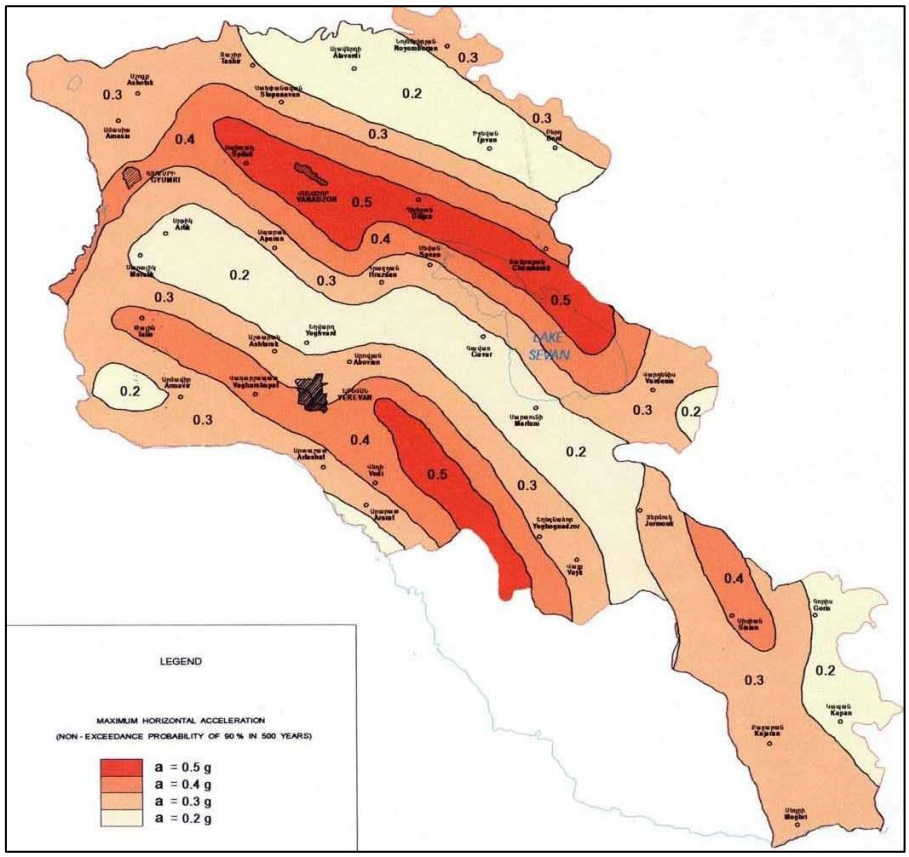
Observation point	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Armavir	18	19	25	32	44	26	12	9	11	25	23	16	260
Qarakert	16	16	23	37	47	31	19	10	13	25	17	16	270
Talin	25	27	37	57	79	52	32	22	20	35	28	24	438

Snow layer: In Qarakert snow layer can be observed on average on December 14, the earliest snow is observed on November 9, the snow melt is on February 24, the latest is March 25. The snow layer remains for 46 days on average, maximum 114 days. In Armavir constant snow layer periods can be observed on December 25 on average, the earliest snow layer can be observed on November 25, the latest on January 26, the constant snow layer elimination can be observed on February 21 on average, the earliest on December 13, the latest on April 3. The frequency of repeated winters without constant snow layers in the region is 55%. The highest snow layer for 10 days in Qarakert on average is 11cm, maximum 39cm.

6.3. Characteristic of Seismic Conditions

Armenia is located in an active earthquake zone. The RA seismic zones schematic map divides the territory of the country into zones as per seismic danger degree magnitude. According to that map (Picture 6.3) Mastara reservoir area is in the zone of horizontal acceleration of ground V=30cm/cm^2 a=0.4g (acceleration magnitude in horizontal direction occurring during earthquake on thick ground layer of upper surface) which is equal to earthquake of 3-9 magnitude.

The requirements of the RA Law “On Seismic Protection” should be kept during the design and construction of the reservoir.



Picture 6.3. Seismic zonation map of the Republic of Armenia

6.4. Lands

The main soil types in Armavir Marz are *arable gray meadow soil, gray semi-desert and hydromorphic salt-alkaline soils.* There are also some outbreaks of original rocks.

Arable gray meadow soils

The arable gray meadow soils have formed at elevation of 800-950m in Ararat valley as a result of combined impacts of human activities for many centuries as well as the ground and surface moistening regimes. The total area occupied by this type of soils in Armavir Marz is 23 604ha.

Gray Semi-desert Soils

The main soil type in 5 target communities: Myasnikyan, Hatsik, Lukashin, Noravan and Khanjyan is gray semi-desert soils which are formed at elevation of 850-1250m in premountanous zone. In Armavir Marz this type of soils occupy 16060ha of land.

Hydromorphic salt-alkaline soils

These soils formed in those sections of Ararat valley where the ground waters are mineralized at the depth of 1-2.5m from the surface. The total surface of these lands in Armavir Marz are 9.15thousand ha.

Outbreaks of original rocks

The area with outbreaks of original rocks in Armavir Marz is 1,681ha.

Picture 6.4. Mastara River at the section of Mastara reservoir in October

Picture 6.5. Water intake from Mastara River in the reservoir area in October

Picture 6.6. H-17 road which is in the area required for Mastara reservoir construction. The soils neighboring the road are typical gray semi-desert depositional soils

Picture 6.7. Measurement of cemented semi-desert crushed, at some placed carbonate subtype of soil profile

Picture 6.8. Outbreaks of original rocks at the reservoir area

The soil in the area of Mastara reservoir is gray semi-desert soil represented with three sub-types:

a) Gray semi-desert depositional type

b) Gray semi-desert crushed type

c) Gray semi-desert crushed, at some places carbonate and cemented type

The soils in the reservoir area are severely rocky and crushed soils and according to the RA Government Decree #1026-N "Technical regulation of requirements for determination of norms for removing fertile layer of the soil, storing and use", point 8a *no norm for removing fertile layer of soil is required* so there is no need for cutting and removing the soil layer.

6.5. Characteristic of Surface and Underground Water Quality

6.5.1. Surface Waters

All rivers in the study area are left tributaries of Araks River. The main water source in the area is Akhuryan River. The total length of the river is 186km. The river decline in the country is 1067m.

The Akhuryan River basin annually provides 263m^3/sec water. These waters are partially lost on the way infiltrating into the rocks. Presently after the construction of Akhuryan reservoir the flow of the river is regulated. The waters of Akhuryan River are used equally with Turkey trough an inter-governmental agreement. Shirak and Talin canals are part of Akhuryan River basin.

Mastara River is a part of Metsamor River basin of Akhuryan River basin management region. Mastara River is the second with its significance in the study area.

6.5.2. Meteorological Characteristic of Mastara Reservoir Water Basin

Mastara River water basin surface is 1635km^2. The river starts at southern slopes of Mount Aragats at elevation of 3100-3300m, and the lowest point of the river is downstream at Metsamor River sources at elevation of 849m. The river basin extends in Aragatsotn, Armavir and Shirak Marzes.

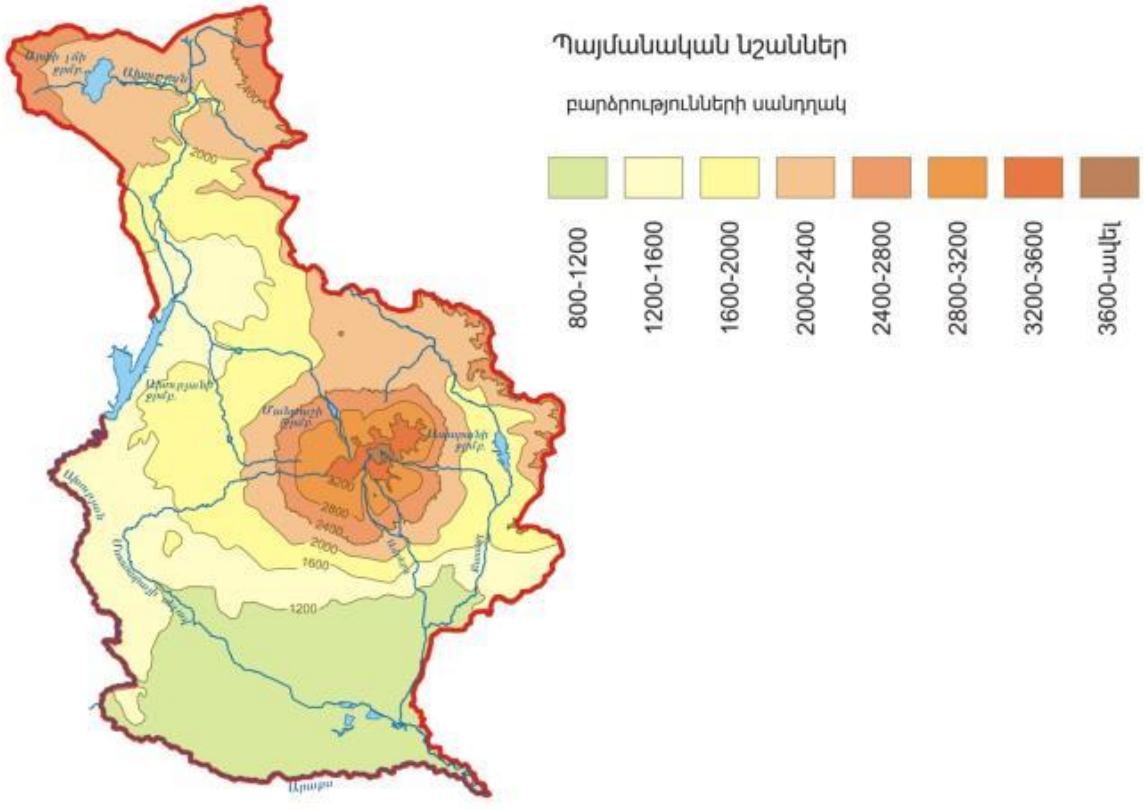
The river bed mark at Mastara reservoir area is at elevation of 928m and the water basin surface at that section is 688km^2, the highest elevation of the river basin is 3289m, and the average elevation is 1517m.

Slav Mastara is a temporary mud flow. The available statistical data analysis show that during rain floods the flow can be more than 40m^3/sec while during large mud flow floods the flow can reach 170m^3/sec (1955).The tributaries of Selav Mastara river are:

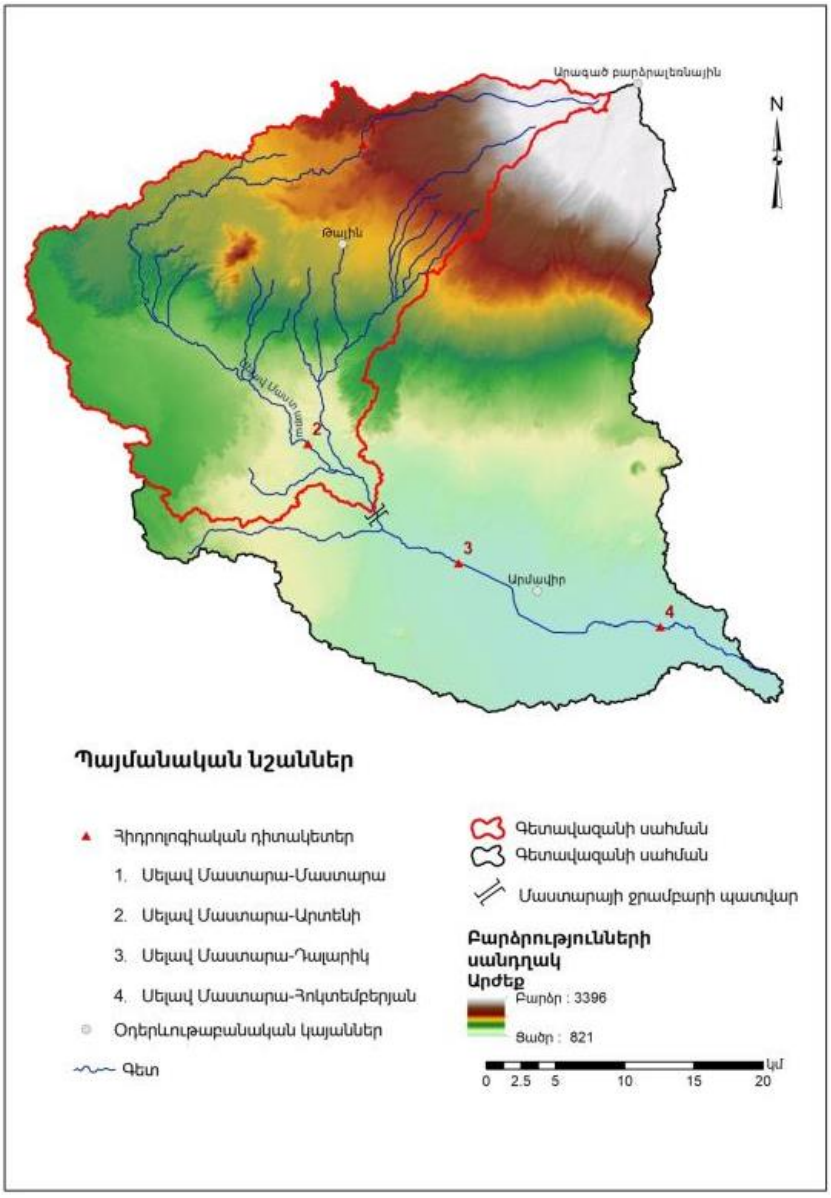
Ashnak – starts at South-Western slopes of Mount Aragats and reconciles with Mastara River from the left side. The length is 38km.

Katnaghbyur - starts at South-Western slopes of Mount Aragats and reconciles with Mastara River from the left side, 6km downstream on South-East of village Karmrashen. The flow exists only in spring. The length is 40km.

Sasnashen – the length is 22km, the water basin is 19km². It starts at South-Western slopes of Mount Aragats. The flow exists only in spring.



Picture 6.9. River basin relief



Picture 6.10. Mastara river basin map-scheme

There are several small reservoirs in Mastara River basin – Nerqin Sasnashen, Davtashen, Talin, Verin Bazmashen, Kaqavadzor, Shenik and Arshak.

Table 6.24 – Mastara River basin reservoirs

Reservoir	River basin	Total volume, mln. m^3	Storage capacity, mln. m^3	Purpose
N. Sasnashen	Sasnashen stream	1.15	1.10	Irrigation
Hatsashen	Selav Mastara	1.11	1.10	Irrigation
Kaqavadzor 2	Shamiram stream	1.00	0.95	Irrigation
Shenik	Selav Mastara	0.78	0.63	Irrigation
Katnaghbyur 1	Selav Mastara	0.40	0.32	Irrigation
Talin 1	Selav Mastara	0.22	0.22	Irrigation
V. Bazmaberd	Sasnashen stream	0.22	0.21	Irrigation
Ashnak 2	Ashnak stream	0.33	0.32	Irrigation
Davtashen	Ashnak stream	0.32	0.29	Irrigation

6.5.3. Akhuryan Basin Hydrological Characteristics

Akhuryan river network belongs to Araks basin. Akhuryan, originated from 2017 m absolute mark – Arpilich reservoir. The length of the river is 186 km, water-catchment basin's 9670 km^2 (including water-catchment in the area of Turkey) of which 2784km^2 is in the area of the Republic. The most abundant tributary of Akhuryan is Kars river in Turkey, which has 139 km length and flows into Akhuryan reservoir. In Armenia, the hugest tributaries of Akhuryan are Karkachun, Tavshut, Ashotsk and Jradzor. Karmrajur, Tsaghkut, Yeghnajur, Dzoraget tributaries are flowing into Arpi river. In Akhuryan basin, the flow rate is quite low 0.24, and it's in case when in the Republic the average value of that characteristic is 0.41.

6.5.4. Collection and Analysis of Existing Materials and Data on Mastara Reservoir Water Basin

To analyze and evaluate the impact of climate change on surface water resources, as well as on water resources, the materials of the surveys carried out so far by the RA MES Hydro-meteorological Service on the observed river flow [4,5,6], air temperature, atmospheric precipitations, snow-cover, etc. Hydrological observations were carried out in Selav-Mastara four hydrological observation points, and now they are still ongoing in Akhurik and Haykadzor hydrological points of Akhuryan river.

For the major part of the abovementioned hydrological observation points, monthly and annual average exits of the river, the dates of beginning and end of the spring inundations, their volumes and duration, maximum and minimum exits with observed period were collected. Gaps in the collected hydrological data, were filled to the extent possible via methods applied in hydrology.

As already mentioned, in various years, on Selav-Mastara river a number of hydrological observation points were functioning. In observation points, the water level, water and air temperature observations, as well as air temperature measurements were carried out.

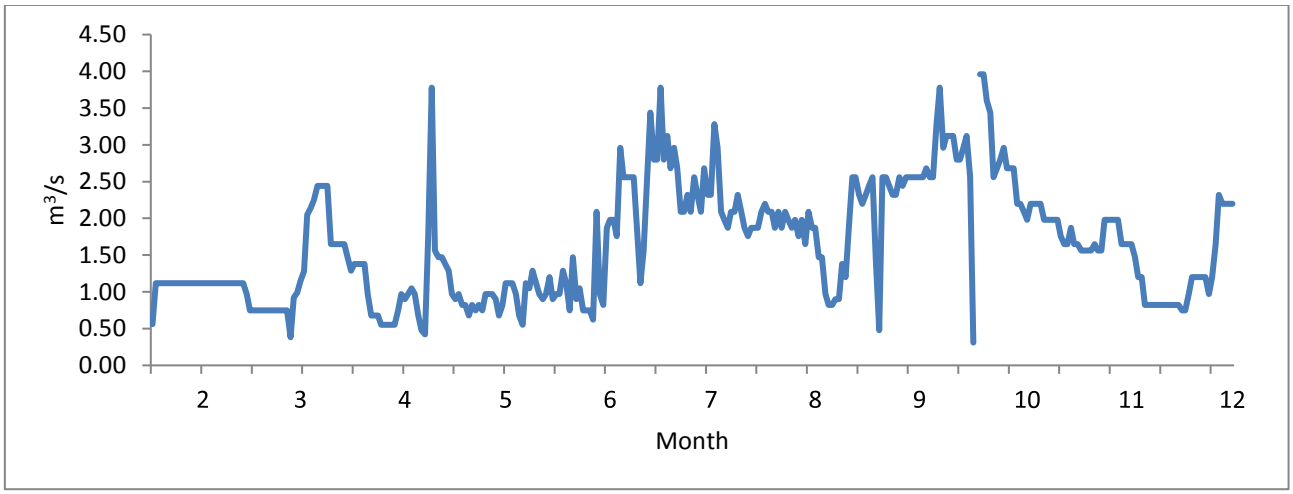
In river basin area of Mastara River, there are also three high-mountainous meteorological stations – Armavir, Talin and Aragats.

In the below mentioned Tables, the perennial average monthly exits of 4 hydrologic observation points are provided.

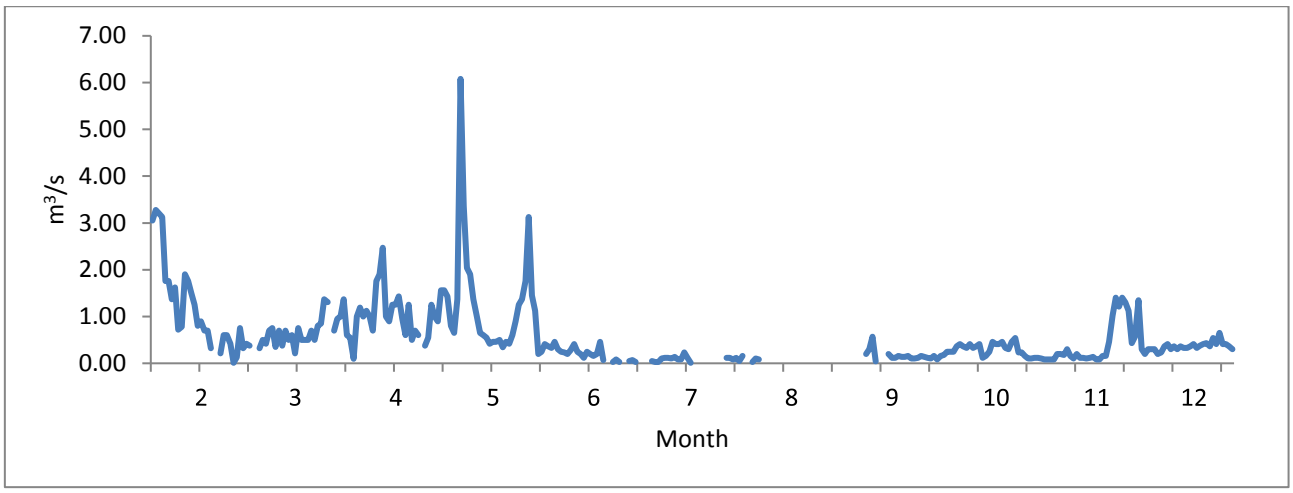
Table 6.25. Selav-Mastara river hydrologic observation points water perennial average monthly exits

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
Selav-Mastara river - Mastara o., years 1936-37, F= 54,0km^2													
Monthly average	-	-	0.074	0.13	0.19	0.16	0.077	-	0.077	0.069	0.053	0.036	-
Selav-Mastara river – Arteni o., years 1960-93, F= 322km^2													
Monthly average	-	-	0.30	1.12	1.90	2.07	1.97	2.11	1.88	1.30	0.62	0.099	1.34
maximum	-	-	1.98	1.97	3.29	3.38	3.22	3.70	4.06	3.33	2.48	1.22	-
Selav-Mastara river – Dalarik o., years 1968-73, F= 693km^2													
Monthly average	-	-	-	2.19	3.38	4.02	2.78	2.57	2.69	-	-	-	-
maximum	-	-	-	3.74	4.08	5.59	3.55	3.58	5.75	-	-	-	-
Selav-Mastara river – Hoktemberyan o., years 1960-62, F= 1380km^2													
Monthly average	-	-	0.57	2.61	1.43	0.95	0.96	0.21	-	-	-	-	-
maximum	-	-	1.07	4.54	2.19	2.14	2.39	0.58	-	-	-	-	-

In the below images, the Selav-Mastara – Arteni and Selav-Mastara – Hoktemberyan hydrologic observation points annual hydrographs of 1961 are presented.

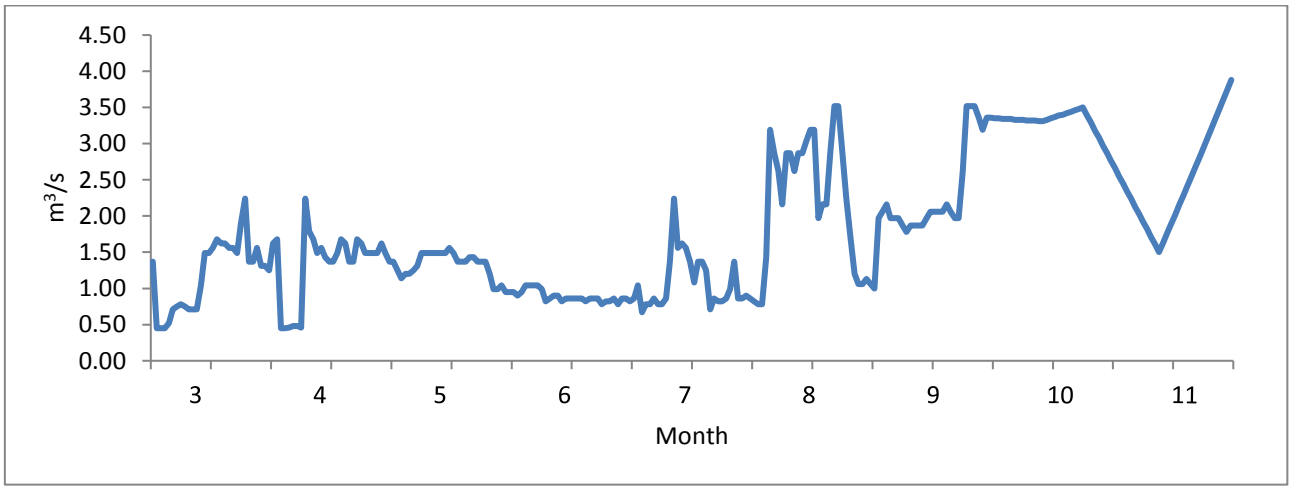


Picture 6.11. Selav-Mastara – Arteni hydrological observation point annual hydrograph for 1961

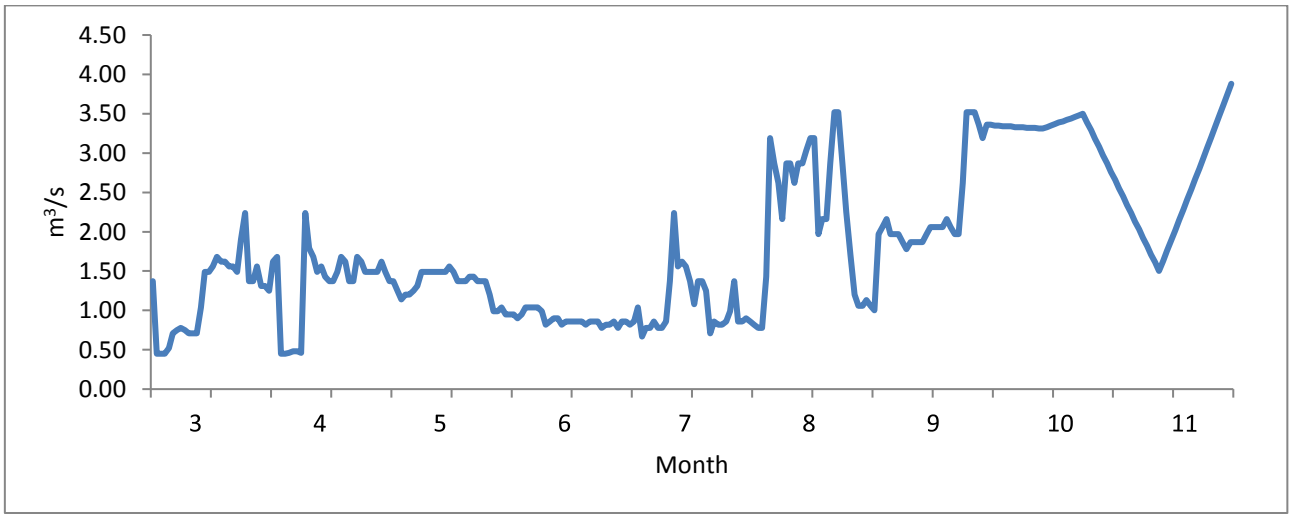


Picture 6.12. Selav-Mastara – Hoktemberyan hydrological observation point annual hydrograph of 1961

Hydrographs' analysis proves that in Selav-Mastara – Hoktemberyan observation point, the flow is more than twice smaller of Arteni, moreover the surface of Hoktemberyan observation point water-catchment basin is 4 times bigger of Arteni observation point surface. It is explained with significant water catchement volumes from the river, as well as with essential filtration from riverbed.



Picture 6.13. Selav-Mastara – Arteni hydrologic observation point hydrograph for 1970



Picture 6.14. Selav-Mastara – Dalarik hydrological observation point annual hydrograph for 1970

The Image shows Arteni and Dalarik observation points average daily exits annual hydrographs for 1970.

The analysis of both hydrographs shows that in Dalarik, where the water-catchment basin surface is about twice bigger of Arteni water catchment basin surface, the annual flow is more than 1.5 times bigger of Arteni.

All these proves that the main water-catchment and filtration from the river takes place in section between Dalarik and Armavir.

In formation of Selav-Mastara flow, the role of snow-cover is big. For the river feeding, with average estimations, more than 40% is provided by snowmelt runoff, as the snow reserve accumulation zone for the formation of river flows are the altitudes ranging between 1800-2800m, in the remaining volume of flows, rainwaters also have huge role, especially showers promoting formation of mudflows. Mudflows cause big damage to coastal cultivated lands and settlements.

In scarce water period, the river is almost dry, and during melt-flows, the mudslide flow may reach up to 170m^3/s and above.

Mastara mudflows reoccur about once in 2-3 years. There is information on Mastara mudflow still of 1905, which all were of mud-stone nature.

Selav-Mastara mudflows mainly form in a result of spring and summer showers, and rarely also in a result of snowmelt-water. In hydrological chronicles, there is information on 165-170m^3/s mudflow exits observed in Selav-Mastara.

Presently, Selav-Mastara riverbed serves as Myasnikyan community canal with soilbed, where water from Talin canal fall into riverbed and are used for irrigation.

In below mentioned Tables, volumes of water that has fall into riverbed from Talin canal in 20017-2016 are shown as per years.

Table 6.26. Volumes of water that has fall into riverbed from Talin canal, mlin, m^3

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Flow	15,346	18,419	20,338	19,063	19,791	22,003	15,908	13,113	17,211	16,980

As the Table shows, the annual volume of water that has fall from Talin canal into Selav-Mastara River ranges between 13.0-22.0 mln.m^3.

The assessment of flow in Selav-Mastara River is based on above 30 years observations of Selav-Mastara river Arteni hydrologic observation point. According to calculations the volumes of annual flow in Selav-Mastara river will be approximately 8.30mln.m^3.

In hydrological chronicles there is information on 165-170m^3/s mudslide exits observed in Selav-Mastara, *mln.m^3*

Table 6.27 – The calculated flow volumes in Selav-Matara River by months

Month	1	2	3	4	5	6	7	8	9	10	11	12	Year
Flow mln.m^3	-	-	0.65	0.68	1.24	1.40	1.11	0.94	1.14	0.97	0.13	-	8.26

In Akhuryan riverbed, the quantity monitoring of surface water resources is implemented in 13 hydrologic observation points, moreover - 11 river and reservoir (Arpilich, Akhuryan).

Table 6.27. Akhuryan river hydrologic characteristics as per hydrological observation points

River-observation point	Years of exploitation	Water-catchment basin area, km^2	Perennial average exit, l^3/l	Flow module ls*km^2	Flow layer, mm	Flow volume, mln.m^3/y	Maximum exit m^3/s	Minimum exit, m^3/s
Akhuryan-Akhurik	1953-2016	1060	7.40	6.98	220	233	182	0,60
Akhuryan Haykadzor	1953-2016	8140	29.0	3.55	112	911	385	0,50

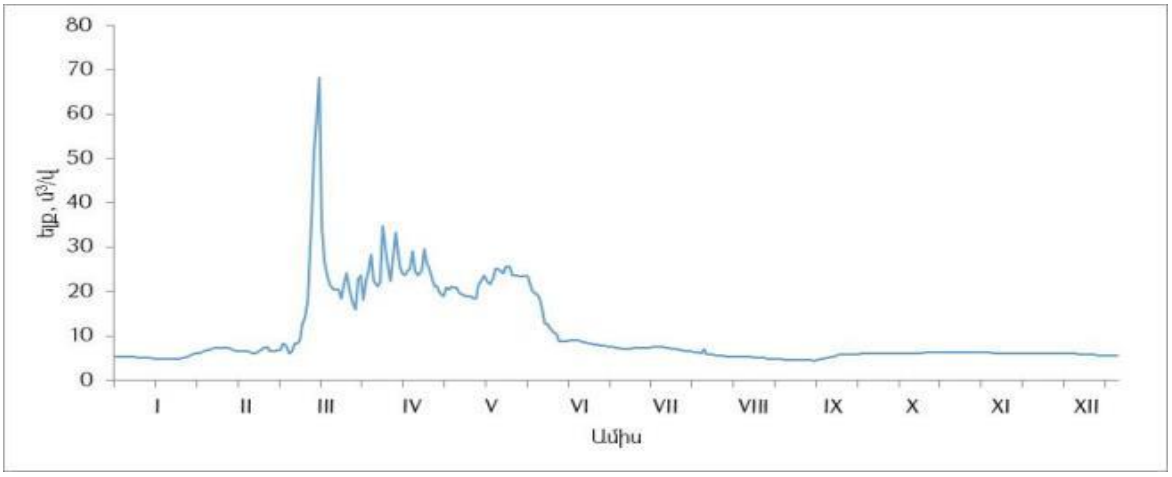
Tale 6.28 – Akhuryan-Akhurik hydrological observation point perennial average monthly exits, m^3/s

Years	Water average monthly exit, m^3/s												Water average annual exit, m^3/s
	1	2	3	4	5	6	7	8	9	10	11	12	
1953	6.60	6.32	7.02	13.6	10.7	6.31	2.39	1.73	2.29	4.00	5.51	5.96	6.04
1954	4.93	6.17	7.49	16.3	15.3	4.40	3.78	2.02	2.04	4.77	6.21	5.44	6.57
1955	6.74	6.40	6.86	10.2	10.1	3.45	5.83	5.31	4.47	4.74	4.76	5.17	6.17
1956	5.06	5.91	5.98	22.1	12.3	2.71	1.67	5.00	4.55	4.80	5.02	4.78	6.66
1957	5.37	5.19	9.71	13.9	6.29	3.44	1.67	1.90	1.82	3.80	4.48	4.66	5.19
1958	4.96	4.85	5.26	10.3	6.13	3.71	1.26	3.86	5.30	4.88	4.94	4.69	5.01
1959	5.48	5.47	5.13	14.1	12.2	10.3	4.92	6.02	3.45	5.38	5.04	5.01	6.88
1960	5.66	7.23	6.80	24.6	12.0	8.53	6.86	15.0	14.8	8.26	6.32	5.73	10.2
1961	5.66	5.56	5.73	8.32	7.10	7.22	12.0	12.9	6.43	5.01	4.53	5.06	7.13
1962	5.25	4.97	6.28	10.7	6.64	1.57	2.31	6.11	4.28	2.75	3.93	4.02	4.90
1963	4.02	4.41	4.09	24.1	25.0	19.7	5.84	2.00	1.32	5.19	8.87	6.68	9.27
1964	6.75	6.94	12.0	21.1	15.3	4.64	5.05	15.7	7.61	4.08	5.59	5.05	9.15
1965	5.47	5.44	7.37	18.9	13.3	2.78	3.26	9.16	9.92	5.29	6.40	5.60	7.74
1966	5.23	5.67	6.23	13.2	11.9	6.13	5.45	9.26	2.59	4.52	4.86	4.12	6.60
1967	3.65	3.81	4.26	10.3	14.5	3.68	2.36	2.66	4.86	2.72	4.40	4.12	5.11
1968	4.77	4.78	5.81	36.8	19.5	7.56	6.95	11.0	10.0	5.83	7.14	6.69	10.6
1969	8.36	7.43	7.49	31.3	26.7	5.19	14.9	14.5	6.15	6.53	6.31	5.71	11.7
1970	6.12	6.23	9.12	23.9	6.09	3.27	3.42	4.25	2.70	5.74	7.28	6.09	7.02
1971	5.96	5.85	9.04	9.68	11.8	5.65	5.32	6.30	3.84	5.46	5.09	6.59	6.72
1972	4.44	4.97	6.42	20.3	13.3	7.71	4.43	7.19	1.90	2.68	5.59	6.97	7.16
1973	5.29	5.30	6.14	22.9	11.9	3.23	4.17	6.77	1.93	2.39	4.73	6.57	6.78

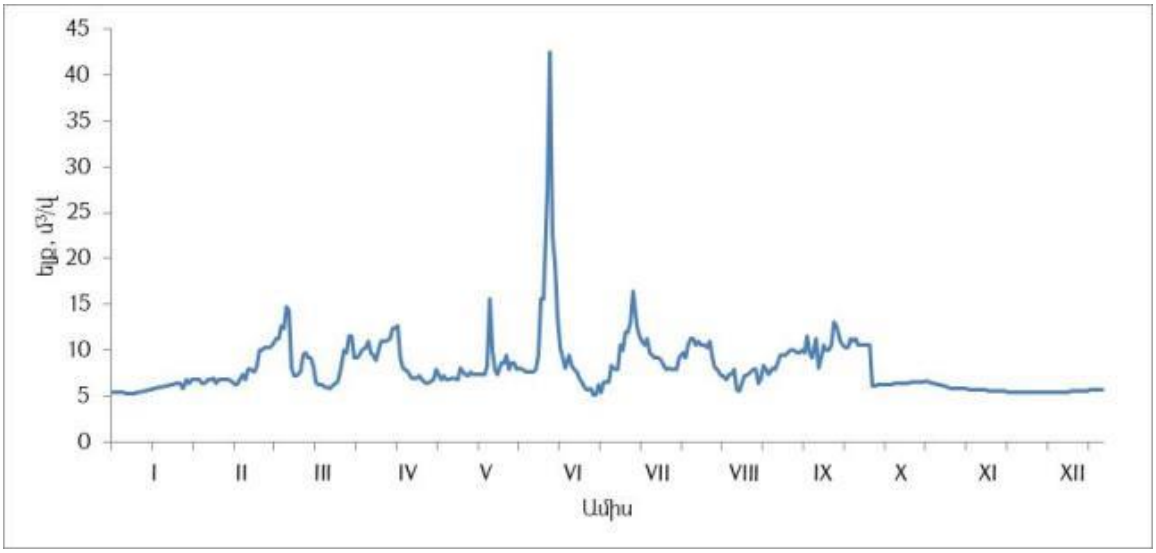
Years	Water average monthly exit, m^3/s												Water average annual exit, m^3/s
	1	2	3	4	5	6	7	8	9	10	11	12	
1974	4.96	4.20	5.09	4.25	8.52	3.14	4.19	6.78	3.16	4.18	4.08	4.75	4.78
1975	3.90	5.06	3.23	8.66	5.92	2.52	10.3	7.38	3.22	4.93	6.78	5.35	5.60
1976	5.45	6.00	8.05	29.8	15.9	9.14	4.17	8.55	8.62	5.96	6.74	6.34	9.56
1977	6.14	6.03	5.36	18.8	14.7	7.47	11.3	15.2	5.09	2.55	5.69	5.05	8.62
1978	5.25	7.38	5.92	26.0	22.6	6.70	10.6	12.8	11.3	5.52	4.12	4.19	10.2
1979	7.70	8.34	10.6	11.0	6.81	5.55	5.64	11.2	3.58	8.41	14.00	8.22	8.42
1980	7.41	6.66	12.1	21.1	5.52	3.16	5.36	4.83	4.40	5.15	5.30	6.19	7.27
1981	6.53	7.25	4.94	7.51	7.07	4.94	6.53	8.02	4.23	3.72	5.49	6.80	6.09
1982	6.67	5.71	5.40	13.0	6.38	5.04	5.59	5.93	5.95	6.36	5.69	5.69	6.45
1983	5.30	4.76	5.07	7.9	7.22	5.51	5.05	3.50	3.13	2.41	4.50	4.64	4.92
1984	5.12	5.09	6.14	18.9	8.36	3.29	3.63	2.83	3.50	3.08	4.54	5.02	5.79
1985	5.72	5.59	6.50	13.0	3.57	3.74	2.93	1.68	2.26	2.52	2.27	4.05	4.49
1986	4.79	5.20	4.41	6.3	7.11	7.27	3.90	3.64	5.45	4.88	3.53	4.66	5.10
1987	5.75	4.83	5.40	15.9	17.8	3.32	2.56	2.55	2.86	4.10	4.88	6.03	6.33
1988	5.07	4.83	5.65	24.4	10.0	13.2	3.47	4.61	6.53	6.00	6.65	6.83	8.10
1989	6.90	6.00	7.20	6.05	3.51	5.79	4.67	7.14	6.92	4.86	2.79	3.55	5.45
1990	4.83	4.34	8.97	26.5	17.1	4.87	3.55	4.38	5.72	3.76	3.77	4.80	7.72
1991	5.25	5.61	12.5	10.7	5.13	5.95	5.37	5.35	5.76	6.91	6.03	5.55	6.68
1992	6.64	7.03	7.76	11.6	8.77	7.31	5.19	5.22	5.68	5.86	6.02	5.97	6.92
1993	5.30	4.93	6.12	14.0	13.6	6.62	4.28	4.75	5.79	5.69	5.43	6.03	6.88
1994	6.15	6.08	6.81	12.7	11.5	6.96	6.96	7.51	5.51	7.15	6.27	9.94	7.80
1995	10.3	10.3	8.00	14.4	10.6	4.50	7.16	6.48	7.81	8.44	7.23	6.94	8.51
1996	7.66	7.58	7.32	14.0	18.0	8.32	7.81	7.05	6.67	6.12	7.39	7.97	8.82
1997	8.01	8.43	8.29	15.3	10.3	8.06	9.14	7.78	7.69	8.08	6.87	7.18	8.76
1998	7.32	7.26	11.2	21.5	15.8	8.81	7.07	7.78	7.91	7.64	7.05	7.27	9.72
1999	6.10	6.01	8.39	10.5	10.4	4.77	4.81	4.88	4.77	5.25	5.64	5.69	6.43
2000	5.66	5.87	8.78	10.9	4.82	4.74	4.53	8.95	6.21	4.79	4.88	5.68	6.32
2001	5.63	5.51	6.30	11.0	7.98	5.62	5.86	5.99	7.80	8.53	5.66	5.50	6.78
2002	5.73	5.61	6.65	11.2	4.64	6.64	4.93	5.71	4.36	5.50	5.58	5.98	6.04
2003	5.75	5.21	5.51	22.7	14.6	12.5	8.89	4.51	4.59	5.90	7.27	5.41	8.57
2004	5.73	5.38	18.4	19.2	22.1	15.5	10.5	11.1	9.00	7.57	6.89	6.16	11.5
2005	6.08	5.60	5.80	20.5	12.8	11.9	6.60	11.2	12.8	13.3	7.57	7.02	10.1

Years	Water average monthly exit, m^3/s												Water average annual exit, m^3/s
	1	2	3	4	5	6	7	8	9	10	11	12	
2006	6.88	7.30	8.31	29.0	18.7	3.73	6.05	6.64	7.11	8.59	6.61	5.81	9.56
2007	5.11	5.06	5.94	16.4	16.4	8.24	6.33	8.63	6.25	7.87	6.55	4.68	8.12
2008	4.88	5.13	13.6	8.06	5.47	7.02	6.27	5.47	7.76	6.74	5.84	5.45	6.81
2009	5.22	5.68	6.65	11.1	11.6	8.54	7.36	9.22	10.3	6.91	5.93	5.52	7.84
2010	5.15	6.78	21.3	24.8	22.1	10.7	7.11	5.34	5.12	6.10	6.16	5.89	10.5
2011	5.89	6.42	5.94	15.4	15.4	8.81	5.78	5.41	6.94	5.59	6.60	6.03	7.9
2012	5.70	5.37	5.28	10.50	7.02	5.18	3.74	7.83	12.6	6.00	5.42	5.87	6.71
2013	6.06	6.33	7.17	10.6	6.51	4.82	3.76	4.03	10.8	5.23	5.97	6.07	6.45
2014	6.26	6.26	7.55	5.24	5.61	3.83	2.48	11.0	3.80	5.46	5.49	5.64	5.71
2015	5.97	5.55	8.25	14.4	15.6	6.40	6.32	9.16	11.9	11.7	6.19	5.50	8.91
2016	5.87	7.62	8.95	9.00	8.01	10.83	9.73	8.28	10.14	7.23	5.71	5.49	8.07
Average	5.84	5.94	7.52	15.79	11.56	6.44	5.65	6.95	5.99	5.65	5.78	5.74	7.40
Max.	10.3	10.3	21.3	36.8	26.7	19.7	14.9	15.7	14.8	13.3	14.0	9.94	11.7
Min.	3.65	3.81	3.23	4.25	3.51	1.57	1.26	1.68	1.32	2.39	2.27	3.55	4.49

As shown in Table, the perennial average annual exit in observation point is 7.40 m^3/s, and the average monthly exits perennial minimum exit is 1.32 m^3/s.



Picture 6.15. Akhuryan-Akhurik hydrological observation point annual hydrograph for 2010



Picture 6.16. Akhuryan-Akhurik hydrological observation point annual hydrograph for 2016

In Akhuryan river basin the Akhuryan reservoir is constructed and commenced in 1983; the reseroir volume is 525mln.m^3, and the useful volume is 510 mln.m^3:

The water accumulated in reservoir for irrigation purposes is released into Akhuryan river, then runs through 6.5km long tunnel and moves to Talin irrigation system.

The observations of Akuryan reservoir hydrological regime carried out since 1983, in Jrap hydrological observation point.

Table 6.29. Akhuryan reservoir volumes as per 1st day of each month for the period from 1998 to 2017

Year	Volume mln.m^3											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1998	50.2	86.8	118.1	189.3	356.4	459.4	445.3	266.7	67.3	18.9	14.5	22.0
1999	59.0	94.3	119.2	187.6	325.0	379.9	330.2	219.2	69.6	35.1	67.9	36.8
2000	70.0	104.7	139.0	191.0	342.1	354.4	240.3	89.0	21.9	26.7	26.5	55.7
2001	85.6	118.8	148.6	204.3	286.9	353.7	257.1	152.8	53.5	32.6	60.3	59.1
2002	91.7	120.1	149.6	207.9	374.0	496.2	517.3	470.1	370.1	281.9	282.3	255.2
2003	282.3	323.0	357.3	405.0	542.0	546.6	498.5	370.7	245.1	184.0	196.4	260.1
2004	317.0	364.6	413.2	526.2	547.0	556.4	544.9	462.9	340.7	265.9	251.6	253.2
2005	301.9	348.7	387.7	472.3	549.2	547.0	510.2	402.0	284.6	252.2	251.9	266.1
2006	319.1	341.7	364.9	438.8	542.8	546.2	431.6	302.3	135.2	73.3	114.1	157.8
2007	197.6	237.3	277.8	379.2	529.5	547.9	493.2	345.1	196.6	104.7	94.6	145.6
2008	191.0	232.5	277.2	523.8	545.8	540.7	439.5	253.8	84.7	28.0	45.8	68.9
2009	104.2	146.9	193.2	271.1	431.3	544.5	542.4	463.3	330.2	241.9	213.0	268.1
2010	326.8	370.9	446.0	550.4	554.3	550.0	533.2	422.9	227.0	119.2	134.6	166.8
2011	226.5	284.6	333.3	406.3	543.6	550.4	517.7	353.1	150.3	66.0	46.5	53.9
2012	102.1	151.1	202.6	268.1	408.3	438.1	309.9	163.2	20.1	16.4	22.5	44.4
2013	84.1	132.2	177.6	268.1	432.6	489.7	419.2	222.3	41.3	29.4	17.8	51.3

Year	Volume mln.m^3											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2014	95.3	143.5	187.8	246.2	279.5	270.0	210.2	67.8	8.10	3.78	8.10	41.6
2015	83.1	124.3	164.5	231.5	380.5	487.9	419.9	230.7	81.9	33.0	86.8	127.5
2016	175.5	222.3	303.4	413.5	474.9	514.2	525.4	369.8	152.2	72.7	55.9	91.7
2017	148.7	198.4	239.5	333.3	427.2	444.2	300.1	119.0	2.20	8.96	34.8	53.2

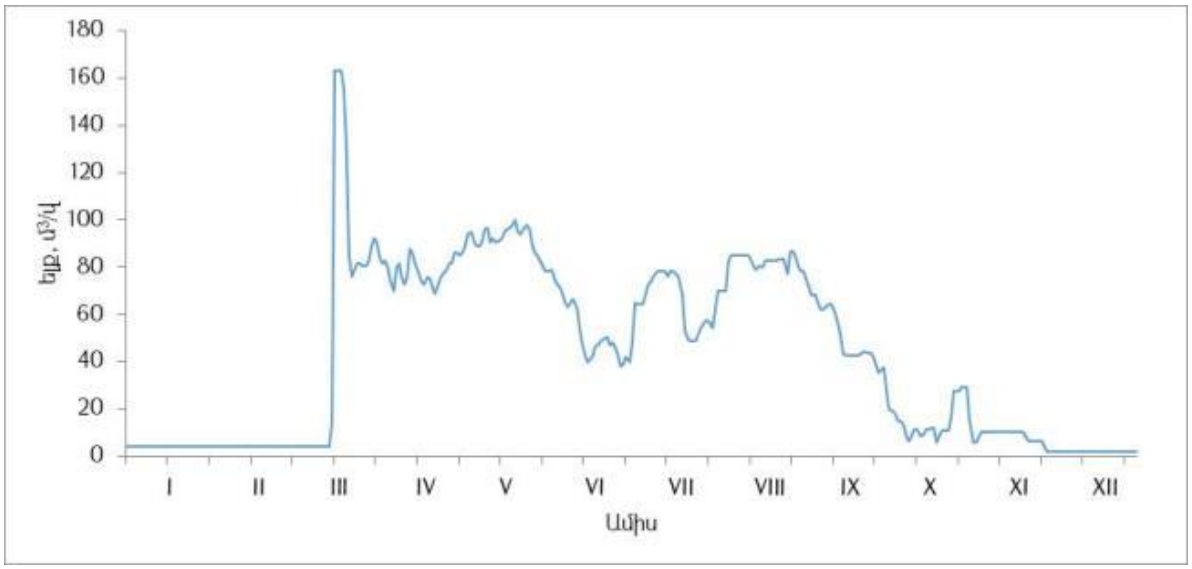
Immediately down the Akhuryan reservoir the Akhuryan-Haykadzor hydrological observation point is functioning. The observations in observation point are carried out since 1953. After commencement of Akhuryan reservoir in 1983, the river flow natural regime in observation point has been disturbed, and for that reason, the Table shows data only for the period from 1984 to 2016.

Table 6.30. Akhuryan-Haykadzor observation point water average monthly exits for the period 1984-2016

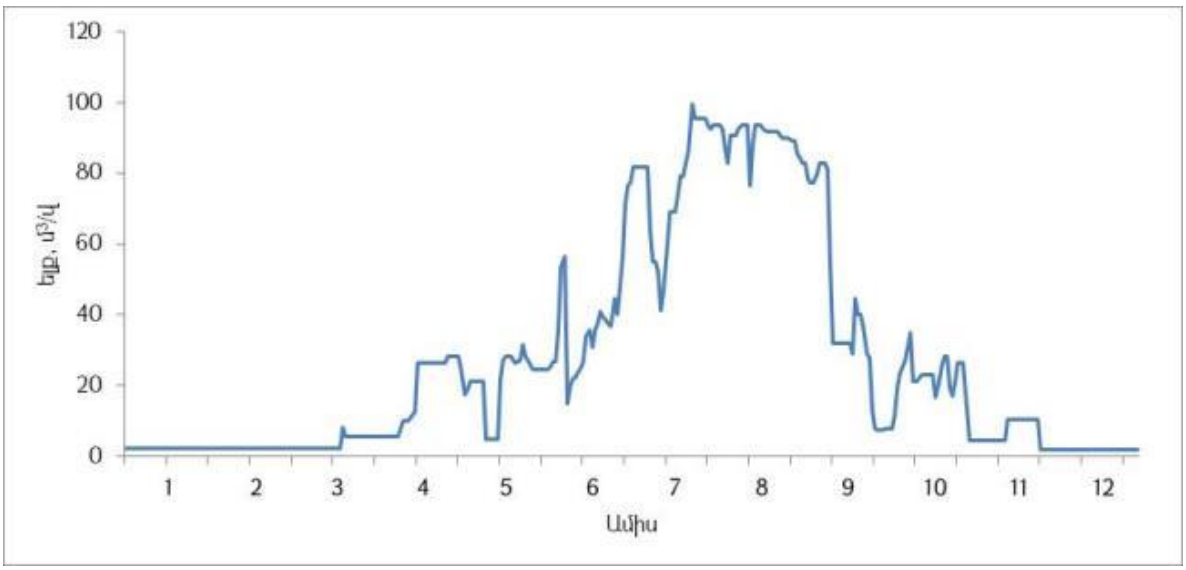
Year	Water average monthly exit, m^3/s												Average annual exit, m^3/s
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1984	3.40	3.40	0.85	7.23	78.2	34.4	44.6	51.9	49.0	42.2	22.2	5.50	28.6
1985	3.00	3.06	3.00	64.0	25.2	38.1	60.5	46.0	39.7	12.8	15.5	5.85	26.4
1986	5.43	5.60	3.70	9.85	16.6	22.2	52.0	57.8	43.5	32.1	13.0	4.17	22.2
1987	3.88	3.88	3.88	10.9	73.2	44.9	58.2	65.4	38.3	32.7	11.9	5.11	29.4
1988	2.90	2.61	1.40	99.0	101	82.7	45.2	42.2	45.6	21.5	18.6	28.1	40.9
1989	19.6	22.4	11.2	25.9	48.0	75.4	59.3	55.8	27.9	15.6	9.92	6.05	31.4
1990	6.00	5.20	5.48	40.6	90.2	37.5	57.0	71.4	63.6	38.6	17.5	7.65	36.7
1991	5.60	5.60	5.91	88.5	48.8	48.5	61.1	71.2	64.2	43.3	31.3	8.74	40.2
1992	3.80	3.80	3.80	5.38	41.3	65.3	53.0	68.4	60.2	37.9	19.2	6.31	30.7
1993	5.80	5.17	5.35	6.96	79.8	66.3	72.3	74.5	72.6	64.3	10.7	6.32	39.2
1994	4.85	4.66	4.66	5.80	17.8	57.5	58.9	49.0	60.3	26.2	10.4	4.66	25.4
1995	6.06	6.06	6.06	9.51	15.6	24.9	45.8	74.6	47.3	22.4	16.6	6.44	23.4
1996	4.10	4.10	4.10	4.10	38.0	48.5	66.4	71.4	48.6	11.6	4.10	4.10	25.8
1997	12.4	12.4	12.4	15.0	26.6	55.6	90.4	99.9	50.5	28.1	30.9	14.9	37.4
1998	5.00	5.00	5.00	6.60	15.8	41.3	77.9	80.5	37.6	20.9	14.6	5.82	26.3
1999	4.77	4.70	2.23	8.08	20.1	40.8	50.1	58.6	29.6	5.39	24.4	6.84	21.3
2000	5.34	5.34	4.99	5.91	21.6	50.5	59.7	33.2	6.39	12.2	8.00	3.02	18.0
2001	3.02	3.02	3.02	4.46	13.3	43.6	45.2	43.2	15.5	5.21	11.9	2.94	16.2
2002	2.10	1.49	1.30	1.58	9.13	23.7	40.4	52.6	44.6	18.8	25.5	5.74	18.9
2003	3.07	3.07	3.07	47.5	55.8	51.9	60.0	52.6	34.6	15.3	7.55	4.46	28.2
2004	4.52	4.77	58.3	56.0	85.9	59.2	53.8	61.9	45.0	31.6	21.2	3.67	40.5
2005	2.80	2.80	2.80	76.9	62.6	52.3	57.2	58.6	36.2	28.4	21.3	5.13	33.9
2006	5.82	14.7	18.3	95.2	90.0	65.0	60.9	65.4	40.3	12.2	5.13	4.05	39.8

Year	Water average monthly exit, m^3/s												Average annual exit, m^3/s
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2007	4.00	4.00	4.45	18.0	86.7	51.9	69.1	65.7	50.5	31.6	5.83	4.00	33.0
2008	4.00	4.00	4.54	38.7	37.5	64.4	76.5	65.9	34.5	7.85	4.51	4.00	28.9
2009	4.00	4.00	4.00	5.21	20.3	32.0	50.8	72.4	41.9	27.0	4.00	4.00	22.5
2010	4.00	4.00	54.0	78.5	91.7	55.2	63.9	80.6	53.8	16.3	8.24	1.90	42.7
2011	1.90	1.90	1.90	16.4	77.0	51.4	81.2	81.3	52.9	24.4	14.9	2.42	34.0
2012	2.42	2.42	2.60	6.47	21.3	59.2	56.3	58.7	21.3	22.0	11.4	1.90	22.2
2013	1.90	1.90	1.90	11.9	21.9	50.2	79.5	76.1	27.5	19.6	6.38	1.90	25.1
2014	1.90	1.90	1.90	4.87	19.8	39.1	60.3	33.3	13.5	12.3	4.90	1.90	16.3
2015	1.72	1.70	1.70	6.54	22.3	51.3	77.1	69.1	35.5	7.51	3.38	2.42	23.4
2016	2.42	2.42	3.88	17.92	21.3	36.9	77.6	90.3	45.9	20.9	6.45	1.90	27.3
Average	*4.59*	*4.88*	*7.63*	*27.3*	*45.3*	*49.1*	*61.3*	*63.6*	*41.8*	*23.3*	*13.4*	*5.51*	*29.0*

In Akhuryan-Haykadzor hydrological observation point the perennial average monthly exit is 29,0m3/s, perennial average monthly minimum - 1,90m^3/s. During months out of irrigation period, the main ecological flow runs in the river.



Picture 6.17. Akhuryan-Haykadzor hydrological observation point annual hydrograph for 2010



Picture 6.18. Akhuryan-Haykadzor hydrological observation point annual hydrograph for 2016

6.5.5. Mastara reservoir water-catchment basin water resource pollution background level

According to the RA Government Decree "On defining water quality provision norms for each basin management area, based on the area peculiarities" (the RA Government Decree of June 27, 2011, N 75-N), the surface water quality assessment system in the RA for each chemical indicator of water is classified into 5 grades as per its status: "excellent" (1st grade), "good" (2nd grade), "satisfactory" (3rd grade), "poor" (4th grade) and "bad" (5th grade). The general assessment of the chemical quality of water is formed by the worst quality indicator grade. If various water quality indicators fall under different water quality grades, then in the final classification - the worst is taken into consideration. The following principle applies: "If one is in bad state – then all are in bad state". The surface water quality control in the RA is implemented by "Hayecomonitoring" SNCO.

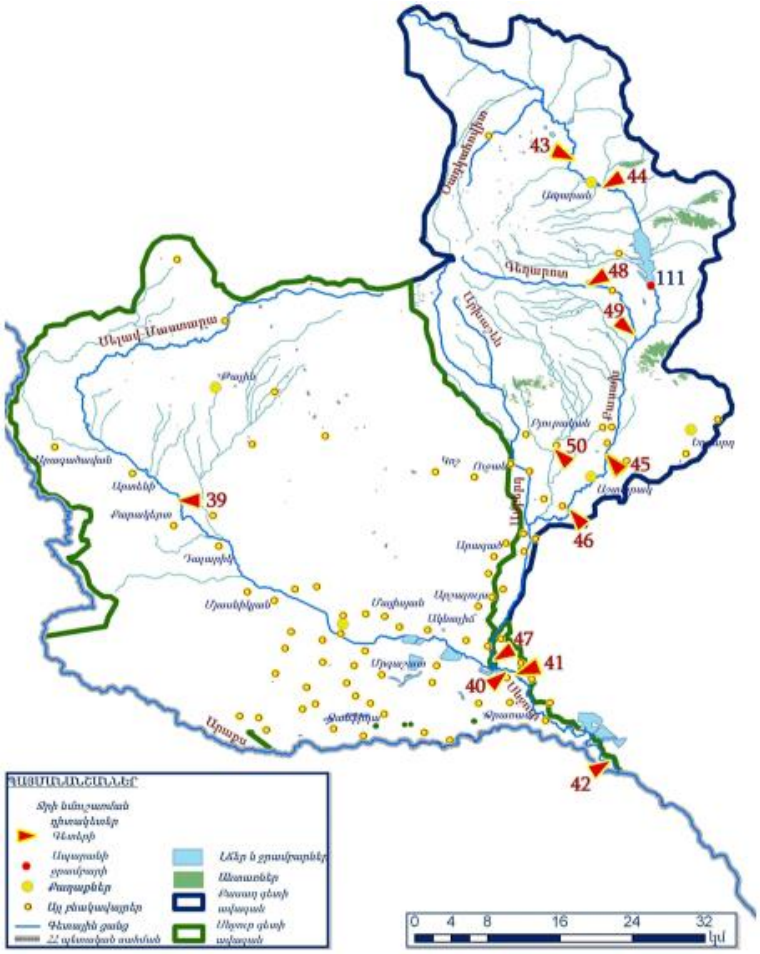
Between Lusakn and Qarakert villages on Mastara River /0,5 km far from Karakert village/, 39th observation point of "Hayecomonitoring" is located, where though no sampling was done during the recent years, and there are no assessments of river water quality.

The Annex 7 of the RA Government Decree of January 27 2011 N 75-N defines the environmental water quality standards of Akhuryan riverbasin management area, which also includes Mastara River as Metsamor's tribute. Those norms are presented in form of table.

Mastara River is directly affected by the coastal villages – Aragatsavan, Arteni, Qarakert, Dalarik, which do not have sewage and treatment plants. Talin town's sewage waters are emitted from the collector into Selav-Mastara internal flow bed, in fact, again falling into Mastara River. Livestock farming, which is developed in Talin and Baghramyan regions, impacts Mastara River. All these results in increased nitrogen, phosphorous, organic compounds and suspended solids density in river waters.

In a result of field trips in the requested area, no source exits were detected.

Below are mentioned "Hayecomonitoring" observation points.



Picture 6.19. Kasakh and Metsamor riverbasins surface waters ecomonitoring observation network

In order to determine the pollution level of Mastara River in the area requested for the reservoir, the sampling and laboratory analysis of river flow water was done.

The survey results are shown in the table, the data of which show that Mastara River water is IV grade water (as per total phosphorous indicator), which is usually a result of pollution by household wastewater. Significantly high levels of arsenic and boron indicators is probably the result of natural high background content of those elements. The high level of hydrogen index /PH/ is disturbing to some extent, as it is in the upper limit of permissible value for irrigation water.

Table 7.31. Mastara Selav river water analysis results

№	***Quality indicators***	***Measurement Unit***	***Quality grade defined by the Annex 7 of the RA Government Decree of 27.01.2011 N75-N***					***Mastara River water quality indicators***		
			I	II	III	IV	V	Analysis results	Quality grade	Analysis method
1	Dissolved Oxygen	mgo_2 /l	>7	>6	>5	>4	<4			
2	BOD_5	mgo_2 /l	3	5	9	18	>18	4,05	II	ISO 5815-1
3	COD-Cr	mgo_2 /l	10	25	40	80	>80	34	III	ISO 6060
4	Amonium Ion	mgN/l	0,080	0,4	1,2	2,4	> 2,4			
5	Nitrite Ion	mgN/l	0,042	0,06	0,12	0,3	>0,3			
6	Nitrate Ion	mgN/l	1,720	2,5	5,6	11,3	>11,3			
7	Phosphate Ion	mg/l	0,1	0,1	0,2	0,4	>0,4			
8	Zinc, total	mcg/l	4.0	100	200	500	>500	0.7	I	ISO 17294
9	Copper, total	mcg/l	3.0	23	50	100	>100	1.3	I	ISO 17294
10	Chromium, total	mcg/l	2.0	12.0	100	250	>250	2.1	II	ISO 17294
11	Arsenic, total	mcg/l	4,2	20	50	100	>100	27.3	III	ISO 17294
12	Cadmium, total	mcg/l	0,01	1,01	2,01	4,01	>4,01	0.02	II	ISO 17294
13	Lead, total	mcg/l	0,13	10,13	25	50	>50	0.09	I	ISO 17294
14	Nickel, total	mcg/l	3.0	13.0	50	100	>100	2.2	I	ISO 17294
15	Molybdenum, total	mcg/l	7	14	28	56	>56	2,0	I	ISO 17294
16	Manganese, total	mcg/l	29	58	116	232	>232	3.9	I	ISO 17294
17	Vanadium, total	Mcg/l	27	54	108	216	>216	18.0	I	ISO 17294
18	Cobalt, total	mcg/l	0,4	0,8	1,6	3,2	>3,2	0.4	I	ISO 17294

19	Iron, total	mg/l	0,11	0,22	0,5	1	>1	0.0974	I	ISO 17294
20	Calcium	mg/l	119,8	100	200	300	>300	57.2	II	ISO 17294
21	Magnesium	mg/l	76,7	50	100	200	>200	25.9	II	ISO 17294
22	Barium	mcg/l	71	142	284	1000	>1000	27.1	I	ISO 17294
23	Berilium	mcg/l	0,024	0,048	0,096	100	>100	0.0018	I	ISO 17294
24	Potassium	mg/l	8,31	16,62	33,24	66,48	>66,48	7.8	I	ISO 17294
25	Sodium	mg/l	112,89	225,78	451,56	903,12	>903,12	45.3	I	ISO 17294
26	Lithium	mcg/l	50	50		<2500	>2500	41.5	I	ISO 17294
27	Boron	mcg/l	623	450	700	1000	>2000	543.6	III	ISO 17294
28	Aluminium	mcg/l	50	100	200	5000	>5000	37.0	I	ISO 17294
29	Selen, total	mcg/l	3,6	20	40	80	>80	1.6	I	ISO 17294
30	Antimony, total	mcg/l	1,2	2,4	4,8	9,6	>9,6	0.05	I	ISO 17294
31	Tin, total	mcg/l	0,08	0,16	0,32	0,64	>0,64	0.031	I	ISO 17294
32	COD-Mn	mgo_2 /l	1,13	10	15	20	>20			
33	Total inorganic Nitrogen	mgN/l	2,271	4	8	16	>16			
34	Phosphorous, total	mg/l	0,174	0,2	0,4	1	>1	0.4041	IV	ISO 17294
35	Chloride Ion	mg/l	146,0	292,	150	200	> 200			
36	Sulphate Ion	mg/l	193,2	386,4	150	250	> 250			
37	Silicate Ion	mg Si/l	15.0	30	60	120	>120			
38	Total mineralization	mg/l	1037	2074	1000	1500* *for irrigation 1000	>1500	679	Suitable for irrigation	ISO 7888
39	Electroconductivity	mcSim/cm	1595,2	3190,4	1000	1500* *for	>1500	441	Suitable for irrigation	ISO 7888

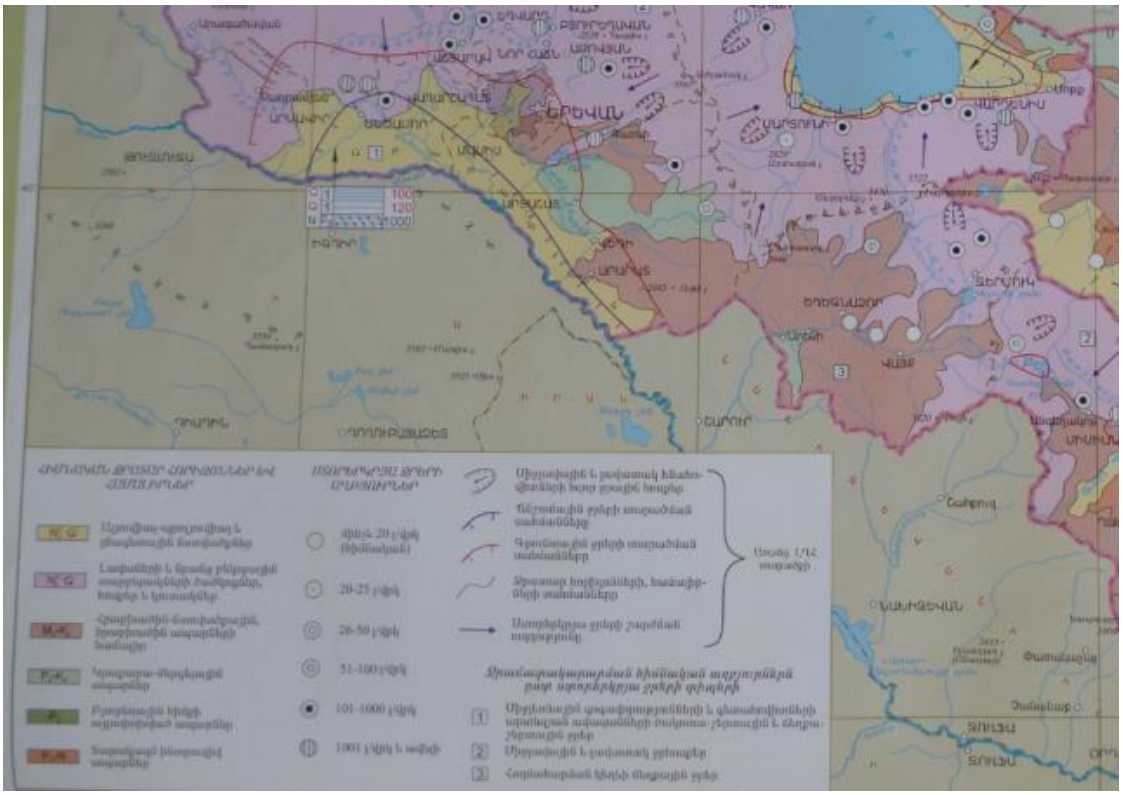
						irrigation 1000				
40	Rigidity	mgecs/l	12,1	10	20	40	<40			
41	Suspended solids	mg/l	6,2	7,5	12,5	25,0	>25,0			
42	Odour (20^{o}C and 60^{o}C)	ball	<2 (natural)	2 (natural)	2	4	>4			
43	Colour	grade	(natural)	<5 (natural)	20	30	>200			
44	Hydrogen Sensor /P^{H}/	P^{H} unit	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6,5-9,0	8,5	For irrigation 6,5- 8,5	ISO10523
45	Strontium	mg/l	-	-	-	-	-	0,236		ISO 17294
46	Titan	mcg/l	-	-	-	-	-	8,5		ISO 17294

6.5.6. Ground Water

Metsamor riverbasin occupies north-western part of Ararat Valley. Here in the aquifer quaternary-modern alluvial-prolluvial and lake-river formations complex two aquifers are identified – ground and first pressure. The groundwater are situated in depths from 0 to 25 m (pre-mountainous zone). Water bearing rocks are represented by gravel, sand, crushed stone, cobble, the aquifer horizon capacity – within range of 15-25 m.

In Metsamor riverbasin, the underground waters are used for drinking, fishery and irrigation. The main part of water-catchment is carried out for fishery. Due to large amount of water-catchment, the pressure water level is decreasing with high intensity (0.15- 0.35 m and more annually). Naturally, the decrease of underground water in water-catchment locations directly impacts the environment. The underground water resources of Ararat Valley are irrevocably lost – flowing into Metsamor and Araks rivers as surface flows and running beyond the RA territory.

The height of reservoir dam on Mastara River is envisaged to be 30 m. Therefore, on the reservoir bed the static pressure value of water may reach up to 3 kg/cm^2, which may result in linkage of ground waters. The reservoir area is close to Ararat artesian basin, which is considered Armenia's drinking water strategic reserve. The hydrographical map of the region is presented in Image 12 from the RA National Atlas. According to that map the underground pressure waters distribution limit passes along the approaches to Armavir town, approximately 12 km away, and ground water distribution limit covers the area requested for the reservoir. The direction of groundwater flow has intermountain basin from Mount Aragats to Ararat Valley and Araks valley artesian waterbasin. The reservoir area is surrounded by a powerful stream of underground waters of inter-lava and under-lava locksmiths. This underground water streams mow are mostly discharged from Ararat valley artesian wells and Metsamor Lake – serving as an origin of Metsamor River.



Picture 6.20. Hydrogeological map of the area requested for the reservoir on Mastara River

6.6. Biodiversity

6.6.1. Terms and general provisions

The survey of Mastara River reservoir region *flora and fauna* has been carried out via office research and route, field works methods.

During the office work stage, the existing published materials on the region's biodiversity were researched, the lists of typical *flora and fauna* species was prepared, their habitats and lifestyle peculiarities, as well as their external description were verified. Particular attention was paid to the flora and fauna representatives involved in the RA Red Book, which probably are in the region. During field works, the specialists visited the region, made observations and took photos, as well as made plants samplings and herbarisation. Then, the collected herbarium and other materials has been studied in the laboratory conditions. When determining plant species, the work "Flora of Armenia" (1-11 volumes, 1954-2010) and other literary sources, were used.

General information on region's biodiversity

Armenia's biodiversity is conditioned by its geological past, as well as by its modern geography. Armenia is a complex combinations of landscapes, volcanic and crustaceous mountains, alluvial valley, mountainous slopes, narrow valley and lake basins. Landscape's difficulties, essential differences between altitudes making vertical zonality – are the reasons of huge differences between natural conditions (climate, hydrology, etc. Armenia is mountainous country, where *landscapes and ecosystems* make complex multifunctional system, which contribute to the creation of rich and unique biodiversity. Geographical distribution of main biodiversity of Armenia's *flora and fauna* is conditioned with *upward zonality* and topographical diversity of the area, due to which the biodiversity of each zone is characterized by its species composition, qualitative and quantitative indicators, and consequently, by its specialized role.

The conditions typical for 10 landscape-climatic zones formed in Armenia contributed to the emergence of big diversity of plant and animal species habitats, resulting in unique assemblages, high level of endemism and rich agro-biodiversity. The fact, that Armenia is in the junction of formation of region's *flora and fauna* from northern part mesophilous Caucasian, from southern part arid Mediterranean and Armenian-Iranic important floristic provinces, as well as serves as transit crossroad for migratory animals and birds. In a result, in a not large area of the country (approximately 30 thousand km^2) grow plants /substandard and high quality -5091 species, of which venomous - 3800 species, indigenous - 142 species, mushrooms - 4207 species, of which 2 species are indigenous, hundreds of algae species, moss and lihens. In territory of Armenia, there are 549 vertebrate /of which 16 indigenous/ and about 17154 species of inverterates, of which 479 indigenous species. /data are presented to the RA Ministry of Nature Protection, from "State Program of the RA biodiversity protection, use and reproduction strategy and action", Yerevan-2015 document/.

Yerevan floristic region

The RA flora as per species distribution is divided into 12 floristic regions. Mastara River reservoir area is situated in Yerevan floristic region of Caucasian plant province. Yerevan floristic region occupies surroundings of Yerevan, the entire Armavir and Ararat Mares, partially Kotayk Marz. For Yerevan floristic region the relatively low vertical zoning areas are typical. Floristic region's height range is 700 -1700 m a.s.l. Here are semi-desert, salt watered marshes, desert and steppe plant assemblages, as well as junipes sparrows. In Yerevan floristic region 1920 high-value plant species were discovered /second after Zangezur floristic region/, of which 46 are *endemic*, and 144 species /the largest number in floristic regions/ is registered in the Red Book of Armenia, and their distribution as per the Red Book IUCN 2001. categories* is the following:

12 species – Extinct (EX) – if in a result of consistent study of the overall historical range of the known or of the supposed natural habitat, no individual was found.

56 species – Critically endangered (CR) – at the extremely high risk of extinction.

39 species - Endangered (EN) – at a very high risk of extinction in the wild.

32 species – Vulnerable (VU) – at the high risk of extinction in the wild.

1 species – Near Threatened (NT).

/Source: RA National Report "On Biodiversity" Convention, Yerevan-2014/.

The present state of the Republic of Armenia plant species was assessed as per International Union for Conservation of Nature developed scale (Red list categories and standards " IUCN, 2001, version 3.1), according to which the relevant species were assessed as per necessary standards – their number, geographic distribution, a number of qualitative indicators, reproductive features, etc.

6.6.2. Flora

The area requested for the construction of Mastara River reservoir of *upward landscape zones* mainly occupies *Semidesert – mountain-lowland /500-1000 m/ and Arid steppe mountain /1000-1600 m/ zones,* which in some places penetrate into each other. *Plant assemblage* species are:

a/ Semidesert vegetation

Wormwoof-ephemeric, with 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, Alyssum, Aeluropus littoralis (Gouan) Parl.

b/ Desert vegetation

Halophile, with participation of Salsola ericoides Bieb., S. dendroides Pall., S. nitraria Pall., Halocnemum strobilaceum (Pall.) Bieb.

Field survey report

in Armavir Marz it is enviasged to construct Mastara reservoir on Mastara River with dam of 30m height and 10,2 mln cubic meters total capacity. The water-covered area of future reservoir will be 80 ha. The reservoir is envisaged to be filled by Mastara and Akhuryan rivers spring inundations flows. The flora of the area envisaged for the reservoir was surveyed.

Floristic survey methods

Surveys were carried out via classical field work modes - route and semi-stationary methods. Herbarium plant species were collected, digital photos of plant species taken and the vegetation description was provided.

The samples were studied and species identified in laboratory conditions. Species identifications and their names verifications was done with "Flora of Armenia" 11 volumes of books, a number of additional works and professional literature were used. The status of the rare and endangered species was verified as per standards developed by the Armenia Red Books of Animals and Plants and by International Union for Conservation of Nature.

General description of the area

The area surveyed is in Ararat valley, in the territory of Dalarik and Lernagog communities of the Armavir Marz, which is entirely included in Yerevan floristic region. It is situated on 930 – 950 m a.m. The type of habitat in the area is semi-desert with prevailing Salsola dendroides and Alhagi pseudoalhagi. This type of habitat is typical for Ararat valley. In the green belt of Mastara River running through the area, there are wetland and mesophilic plant species growing. In the drought years, the riverbed dries.

Through certain part of the area, the irrigation channel is also running, along which also the xerophyte plant species are growing.

A part of the area is covered with stone heaps covered with petrophil vegetation typical for them.

Flouristic survey results

Semi-desert

It is interesting, that on an essential part of the area, Salsola dendroides is prevailing, and on an another essential part in the vicinity – it is Alhagi pseudoalhagi which prevails. Here occur the representatives of Goosefoot family (Chenopodiaceae), Saltbush (Atriplex micrantha C.A.Mey.), Rareflower heterocodon (Halanthium rarifolium K.Koch), Thorny saltwart (Noaea mucronata (Forsk.) Asch. et Schweinf.), Salsola dendroides Pall., Nitrosalsola (Salsola nitraria Pall.), Salsola verrucosa M. Bieb., Salsola Florida (Seidletzia florida (M. Bieb.) Boiss.), Goosefoot (Chenopodium album L.). Of Pine family (Peganaceae) here occur Esfand (Peganum harmala L.), of Caltrop family (Zygophyllaceae) - Syrian bean-caper (Zygophyllum fabago L.), of Dodders (Cuscutaceae) - Cuscuta cesattiana, which parasitizes on thistle. Of Nightshades (Solanaceae) there occurs Small Henbane (Hyoscyamus pusillus L.).

Picture. 6.21. Semi-desert landscape remaining under Mastara reservoir

Picture 6.22. Salsola nitraria Nitrosalsola

Picture 6.23. Seidletzia florida Salsola Florida

Some other plant species typical for semi-deserts also grow here, e.g. Common Chicory (Cichorium intybus L.), Common yarrow (Alchemilla millefolium L.), Wild wormwood (Artemisia fragrans Willd.), Hawksbeard palestinian (Crepis sancta (L.) Babc.), Prickly burweed (Xanthium spinosum L.) and Italian cocklebur (Xanthium italicum).

Picture 6.24. Halanthium rarifolium

Picture 6.25. Atraphaxis spinosa

Picture 6.26. Salsola verrucosa

Picture 6.27. Glycyrrhiza glabra Liquorice

Feverfew (Tanacetum argyrophyllum (K.Koch) Tvzel.), Rush skeletonweed (Chondrilla juncea L.), Picnomon acarna (L.) Cass.

The Poaceae family is also well represented. Here occur Bulbous bluegrass (Poa bulbosa L.), Couch grass (Elytrigia repens (L.) Nevski), Meadow Fescue (Festuca pratensis Huds.), Eremopoa songarica (Schrenk) Roshev, British timothy (Phleum paniculatum Huds.), Stalked burgrass (Tragos racemosus (L.) All), Japanese brome s\s. anatolicus (Bromus japonicus ssp. anatolicus (Boiss. et Heldr.) Penzes), Comb wheatgrass (Agropyron pectinatum (M.Bieb.) P. Beauv.).

Of Legumes (Fabaceae) occur Small Got's-thorn (Astragalus microcephalus Willd.), with one individual occur Liquorice (Glycyrrhiza glabra L.), Black medick (Medicago lupulina L.), Alfalfa (Medicago sativa L.), White clover (Trifolium repens L.). Camelthorn (Alhagi pseudoalhagi (Bieb.) Desv.) in some parts is the prevalent plant species.

There are also representatives of other families growing with not so rich vegetation coer. Of Umbellifers (Apiaceae) here occur Field eryngo (Eryngium campestre L.), of Medders (Rubiaceae) – Spreading

bedstraw (Galium humifusum M. Bieb.), of Mints (Lamiaceae) – Kochi thyme (Thymus kotcshyanus Boiss. et Hohen.), of Smartweeds (Polygonaceae) – Birdweed (Polygonum aviculare L.), Atraphaxis spinosa L., of Bindweed (Convolvulaceae) – Filed bindweed (Convolvulus arvensis L.), of Carnations (Caryophyllaceae) Peacock-eye pink (Dianthus aristatus Boiss.). Of Spurges (Euphorbiaceae) occur Boissier's spurge (Euphorbia boissieriana (Woronow) Prokh.) and Siberian spurge (Euphorbia seguierana Neck.).

Picture 6.28. Mastara River's riverside vegetation

The green belt of the river is represented by mesophyll vegetation, the composition of which is not that rich. Of Poaceae there are Common Reed (Phragmites australis (Cav.) Trin. ex Steud.), Elytrigia trichophora (Link) Nevski). Of Plantains (Plantaginaceae) – Broadleaf plantain (Plantago major), of Mints (Lamiaceae) - Horse mint (Mentha longifolia (L.) L.), of Portulacaceae - Pigweed (Portulaca oleracea L.), of Crucifers (Brassicaceae) there are Marsh cress (Rorippa islandica (Oeder) Borbas), of Buckwheats (Polygonaceae) - Marsh pepper (Polygonum hydropiper L.).

Picture 6.29. Mentha longifolia Horse Mint

Picture 6.30. Rorippa islandica Marsh Cress

Part of the area is rocky. The flora here is very poor. In cracks of stones here and there occur Rhamnus pallasii Fisch. & C. A. Meyer, of herbs there are growing: of Mints (Lamiaceae) - Kochi thyme (Thymus kotcshyanus Boiss. et Hohen.), of Spurges (Euphorbiaceae) - Euphorbia marschalliana Boiss. Of Poaceae family there are Stalked burgrass (Tragos racemosus (L.) All), Festuca sclerophylla Boiss. ex Bisch., Creeping Bentgrass (Agrostis stolonifera L.), Prairie junegrass (Koeleria kurdica Ujhelyi), Crested wheat grass (Agropyron pectinatum (M. Bieb.) P. Beauv), etc.

Picture 7.31. Euphorbia seguierana Siberian Spurge

Picturee 7.32. Tragos racemosus Stalked Burgrass

There are very few representatives of dendroflora, and except of Buckthorn, of other trees and shrubs there are one or two individuals. There is Caspian Locust (Gleditschia caspica Desf.), which in Armenia occurs in cultivation. In the area is also growing Saltcedar (Tamarix ramosissima), Rhamnus pallasii Fisch. & C.A. Meyer. As a small bush Small Got's-thorn (Astragalus microcephalus Willd.) can be mentioned.

Picture 6.33. Gleditschia caspica Caspian Locust

Picture 6.34. Astragalus microcephalus Small Got's-thorn

Apart of the abovementioned plants, in the region occur also such plants, which are widespread in all regions of Armenia.

1. Black henbane /Hyoscyamus niger/;
2. Common nettle /Urtica dioica/;
3. Common dandelion /Taraxacum officinalis/;
4. Common chicory /Cichorium intybus/;

5. Perforate St John's-wort /Hypericum perforatum/;
6. Kochi thyme /Thymus Kotschyanus/;
7. Common wormwood /Artemisia absinthinum/;
8. Curly dock /Rumex crispus/;
9. Common purslane /Portulaca oleraceae/;
10. European dewberry /Rubus caesius/;
11. Sickleweed /Falcaria vulgaris/;
12. Common mallow /Malva neglecta/.

Thus, by the field vistis to the envisaged Mastara reservoir area, as well as by comparison and identification of existing literary data it's been proved that in the immediate reservoir area and in the area adjacent to it, there are no plant species requiring special protection, endangered, vulnerable, on the brink of extinction and registered in the RA Red Book or in the IUCN Red List. The land plot under the designed reservoir and the adjoining area have low ecosystem value because of the scarce vegetation and the absence of sensitive habitats and community assemblages.

6.6.3. Fauna

Fauna of the Republic of Armenia is prominent with diversity of species composition. The survey of the fauna of Armenia is still ongoing; the survey of vertebrate species is nearly completed, which is not the case with invertebrates, of which only about 30% have been studied.

Fauna of Armenia is prominent with its high endemism - 495 species (about 3 % of fauna), of which major part – are invertebrates.

In semi-deserts occur many endemic invertebrate species, including those with Mediterranean, Iranian, Caucasian and Crimean origin. The existence of endemic species – Armenian Cochineal (Porphirophora hamelii) is related to the salt marsh hallophile assemblages. The unique and underresearched semi-desert landscape in the valley of Araks river – in north-western part of Armavir marz, is of big interest. Due to geographical conditions of the area, here are preserved such rare, disappearing and endemic fauna species, which almost never occur in other landscapes.

In semi-desert ecosystems of Armenia are registered 101 species of vertebrates (4 amphibious, 30 reptiles, 23 birds, 11 mammals) and 1687 species of invertebrates (including 59 mollusks, 97 arachnids, 1531 insects). Most of 51 species of reptiles widespread in Armenia occur in Ararat valley, including in Armavir marz.

The surveyed Mastara reservoir area is situated in the RA Armavir Marz, in semi-desert area between Myasnikyan and Dalarik communities. The location is a deforested area, for which *arid strictly continental climate* conditions are typical.

The surveys were mainly carried out via field observation method. The existing literary data on fauna of the surveyed area of Armavir Marz were analyzed.

Terrestrial vertebrates' routes records were made by adopted methods (Формозов, 1951, 1976: Новиков, 1953; Гептнер, 1967, etc.).

Observations of mammals are mostly accidental. Most often traces of their activities were recorded. Relevant woutes have been selected in advance. Birds observations were made with "Bushnell'' telescopes. Geographical location of the site was registered with GPS.

Survey results

The following animal species are registered in the area surveyed in a result of carried out surveys and analysis of existing literary data.

There are almost 17000 invertebrate species in Armenia, of which about 30% is researched. Semi-desert areas are particularly abundant with various invertebrate species. In the surveyed area, there are no

invertebrates registered in the Red Book of Armenia. Of Red Book registered animals, the most prominent in Armavir marz is Armenian Cochineal /Porphyrophore hamelii/, for which the reserve is dedicated. Other Red Book registered invertebrates are mainly concentrated in the vicinity of Metsamor lake and in coastal areas of Araks river.

During field works in the area surveyed, were detected two species of ants, 5 species of Orthoptera, 2 species of Mantis, 5 species of arachnids, 4 species of beetles, etc., with the images of some of those presented.

Vertebrates

In the region of the area requested for the Mastara reservoir, the following *amphibians* were found.

Variable toad /Bufotes variabilis/

Middle East tree frog /Hyla savignyi/

Marsh frog /Pelophylax ridibundus/

Picture 6.35. Scorpion

Picture 6.36. Black beetle

Picture 6.37. Saga

Picture 6.38. Orthoptera

Picture 6.39. Common Fox

Picture 6.40. Hare

Picture 6.41. Pied Wheatear, male /Oenanthe pleschanka/

Picuture 6.42. Finsch's Whetear /Oenanthe finschii/

Reptiles are represented by following species.

Strauch's racerunner / Eremias strauchi/
Snake-eyed lizard /Ophisops elegans/
Striated lizard / Lacerta strigata/
Black-headed ground snake /Melanocephalus satunini/
Collared dwarf racer /Eirenis collaris/
Ring-headed dwarf snake /Eirenis modestus/
Dahl's whip snake /Platyceps majadum/
European cat snake /Telescopus fallax/
Dice snake /Natrix tessellata/

Of lizards the most numerous are Strauch's racerunner.

We did not succeed to take pictures of snakes; the traces of their vital activity were detected. The first three snakes – Eunuchs', live a very hidden life. They feed on insects, ants pupa, arachnids, including scorpions. The availability of abundant food for Eunuchs' snakes was registered in the area requested for the reservoir.

Picture 6.43. Strauch's racerunner /Eremias Strauchi/

Picture 6.44. Striated lizard /Lacerta strigata/

Birds

Photoes of the birds detected in the area of Mastara Selav reservoir are presented as Images. As per literary data /Martin S. Adamyan, Daniel Klem Jr. Birds of Armenia, American University of Armenia publishing house 2000/, the bird fauna typical for the region are presented in form of table.

Mammals

During field works, no mammals were met, though the traces of rodents vital activity, mainly burrows, were detected. Unique and in need of protection mammal species of the region which potentially may be met – are presented in the table.

In the region of the area requested for Mastara reservoir the following widespread animals occur: of vertebrates – Rana ridibunda, Rock lizard, Grass snake; of birds – House sparrow, Carrion crow, Porcupine; of rodents – Common vole and Social vole; of predators – wolf, fox, weasel; of invertebrates – earthworm, ants, bee, bush cricket, cricket, grasshopper, bed bug, certain butterflies, cabbage butterfly, mosquito, housefly and face fly.

In general, the construction and further exploitation of the reservoir will definitely have certain negative impact on the given area, as well as on the animal species living in adjacent areas, as after reservoir construction not only will the animals habitats disappear, but the micro-climate of the given and of the adjacent areas will also change rapidly.

Thus, during and immediately after construction of the reservoir, it is desirable to carry out flora and fauna indicator species' monitoring. In addition, certain resettlement activities for some animal species will be implemented, if necessary.

Table 7.32. Semi-desert zone birds

N	Species	Breed	Latin name	Status	Documented areas
1	Eurasian stone-curlew		*Burhinus oedicnemus*	Nesting	From Ararat valley saline soils to outskirts of Yerevan – with sparse shrubs and rocky hillsides
2	Bimaculated	lark	*Melanocorypha bimaculata*	Nesting	In semi-desert and sowing-areas of mountain-steppe and haylands of Vayots dzor, Ararat, Armavir, Geghama mountains southern hills
3	Calandra	lark	Melanocorypha calandra	Nesting migrating, widespread	In semi-deserts, steppe
4	Lesser short-toed	lark	Calandrella rufescenc	Nesting migrating, widespread	In semi-deserts, steppe
5	Greater short-toed	lark	Calandrella brachydacatyla	Nesting migrating, widespread	In semi-deserts, steppe
6	Crested	lark	Galerida cristata	Sedentary, widespread	In semi-deserts, steppe
7	Common kestrel	hawk	*Falco tinnunculus*	Nesting	Across the country
8	European	bee-eater	*Merops apiaster*	Nesting	From Syunik to northern border of Shirak
9	Hoopoe		*Upupa epops*	Nesting	On the borders – from Syunik to Shirak marzes
10	Crested	lark	*Galerida cristata*	Nesting	In Vayots dzor, Ararat, Armair, Syunik marzes, Geghama mountains eastern slopes haylands
11	Eurasian	skylark	*Alauda arvensis*	Sedentary, widespread	In Syunik, Vayots dzor, Ararat marzes, to the north from Gegharkunik marz – in mountain-steppe and alpine meadows zone of Shirak Marz
12	Woodchat	shrike	*Lanius senator*	Nesting	In Syunik, Vayots dzor, Ararat, Armavir, Aragatsotn marzes semi-desert areas – with thorny shrubs and trees
13	Lesser grey	shrike	*Lanius minor*	Nesting, migrating, less common	In semi-desert, rocky mountain slopes
14	Rufous-tailed scrub robin	nightingale	*Cercotrichas galactotes*	Nesting migrating	In semi-desert, rocky mountain slopes
15	Northern	wheatear	*Ocnanthe ocnanthe*	Nesting migrating, widespread	In semi-desert, rocky mountain slopes
16	Isabelline	wheatear	*Ocnanthe isabellina*	Nesting migrating, widespread	In semi-desert, rocky mountain slopes
17	Finsch's	wheatear	*Ocnanthe binschii*	Nesting migrating, widespread	In semi-desert, rocky mountain slopes
18	Black-eared	wheatear	*Ocnanthe hispanica*	Nesting migrating, widespread	In semi-desert, rocky mountain slopes

19	Pied	wheatear	Ocnanthep leschanka	Casual migrant	In semi-desert, rocky mountain slopes
20	Blue rock	thrush	Monticola solitarus	Nesting migrating, widespread	In dry rocky hills and canyons
21	Menetries's	warbler	*Sylvia mystacea*	Nesting migrating, widespread	In south of Syunik and on the territory of Ararat valley
22	Ortolan	bunting	*Emberiza hortulana*	Nesting migrating, widespread	In mountain-steppes of Vayots dzor, Tavush and Lori
23	Black-headed	bunting	*Emberiza melanocephala*	Nesting	From semi-deserts to sub-alpine cereal sowing-areas, haylands and orchards
24	Upcher's	warbler	*Hippolais languida*	Nesting	In the dry shrub zone of the Republic's semi-deserts
25	Eurasian tree	sparrow	*Passer montanus*	Sedentary, less common	Mountain meadows, steppes, semi-deserts

6.6.4. Aquatic Life

Mastara reservoir is intended to be constructed in Armavir Marz – in Selav Mastara valley, in Selav Mastara riverbed about 4 km to the north from Armavir canal, in the areas of Dalarik and Lernagog communities. Reservoir is intended to be filled by Selav Mastara and Akhuryan rivers spring flood flow. Selav Mastara river originates from Aragats mountain foothills on above 3000 m marks. Their flow is being formed mainly from melt water and its water-catchment basin rains. In spring months, the flood flow is not used for irrigation neither by the Republic of Armenia nor by Turkey and it may be transferred to Mastara reservoir through Talin irrigation system. Mastara reservoir earthen dam will have maximum 30 m height anti-filtration nucleus and 1246 m length. Based on hydrological calculations and location conditions, the total capacity of the reservoir is estimated 10.2 mln cubic meters, and its storage capacity - 8.2 mln cubic meters. The reservoir is intended to be filled by Sela Mastara river's free streams 2.0 mln cubic meters. The remaining 8.2 mln cubic meters – from Akhuryan river in months II-II – from free stream in the section from Akhuryan reservoir to Talin irrigation system head-knot. 8.2 mln $c.m^3$ stream will be moved to Talin irrigation system through tunnel. Mastara reservoir beneficiaries will be the communities located beyond 27 km from Armavir main channel –Hatsik, Myasnikyan, Lukashin, Norapat and Noravan, where 3794 ha lands are irrigated, and 590 ha additional lands are presently non-cultivated irrigable areas. The number of water users is 4432. Mastara reservoir is intended for irrigation of 4384 ha land. In a result of project implementation, it is expected to save annually about 2.1 mln kWt/h electricity – due to decommissioning of deep wells.

Selav Mastara is temporary functioning flood watercourse. Its river basin main tributaries are Ashnak, Shamiram, Selav Getap, Barozhi dzor, Katnaghbyur, Kalakut, Kadjarabad. There are reservoirs on the rivers, of which are functioning Nerkin Sasnashen, Davtashen, Talin, Verin Bazmaberd, Kakavadzor, Shenik and Ashnak reservoirs. Selav Mastara is flowing into Metsamor river.

In previous years, the fish fauna of Mastara River, as well as its tributaries and reservoirs constructed on them, was not subject to any fishery studies. Only in 1986 of the past century, in surroundings of Armavir town in the end of July, in Mastara River small water pits preserved in dryed up flood stream, we detected a Silver carp.

Considering the communication of Selav Mastara with Metsamor river, it is likely that Metsamor river certain fish species will penetrate into Selav Mastara, especially during its floods, when fish species migrating for reproduction purposes rise upstream looking for suitable spawning places.

It is well known, that in Metsamor river there are 31-33 fish species (Pipoyan, 2012), of which most

probably the following can be met at the lower stream of Selav Mastara River:

1. Kura chub/indigenous fish species/
2. Kura barbel / indigenous fish species/
3. Kura nase / indigenous fish species, restricted range /
4. Caucasian scraper/ indigenous fish species/
5. Kura bleak / indigenous fish species/
6. Common carp/ indigenous fish species /
7. Squalius orientalis/ indigenous fish species /
8. Silver carp / climate-adapted fish species /
9. Stone moroko / climate-adapted fish species /.

In addition, the attempts of amateur fishermen and farmers of various fish species dispersing, climate adapting and fish breeding in reservoirs constructed on Selav Mastara tributaries and in upstreams of those tributaries, cannot be excluded, and it is now widely observed in the RA other riverbasins. In a result, it is likely to meet the following fish species in Selav Mastara upstreams:

1. Trout /indigenous fish species, likely to be met in upstream tributaries of Selav Mastara streams/
2. Carp /is an adapted form of Common carp/
3. Rainbow trout /it's a fish species raised in trout farms, from where it accidentally occurs in natural water reservoirs/
4. Silver carp /climate-adopted species widespread also in highland reservoirs of Armenia/.

Taking into consideration the periodically occurring communication of Akhuryan river with Selav Mastara through Talin channel, there is a probability of occurrence there of fish species living in Akhuryan river. As per our previously carried out surveys (Pipoyan, 2010; 2012), in AKhuryan river, including in Akhuryan reservoir, the following fish species can occur:

1. Trout /indigenous fish species, occurs in upstream tributaries falling into Akhuryan river, restricted range /
2. Squalius orientalis/indigenous fish species/
3. Asp / indigenous fish species, registered in the Animals Red Book of Armenia/
4. Kura nase/indigenous fish species, restricted range /
5. Caucasian scraper/ indigenous fish species /
6. Kura barbel / indigenous fish species /
7. Bulatmai babel / indigenous fish species /
8. Luciobarbus mursa / indigenous fish species /
9. Kura bleak / indigenous fish species /
10. Kura chub / indigenous fish species /
11. Blackbrow bleak/ indigenous fish species /
12. Common carp/ indigenous fish species / and its adapted form – carp
13. Angora loach /indigenous fish species/
14. Kura loach / indigenous fish species/
15. Golden spined loach / indigenous fish species, registered in the Animals Red Book of Armenia/
16. Wels catfish / indigenous fish species/
17. Stone moroko /climate-adapted fish species/
18. Pussian carp /climate adopted fish species/
19. Silver carp /fish species raised in fish pond farms, from where it accidentally occurs in natural water reservoirs, with no cases of natural reproduction registered so far/
20. Bighead carp / fish species raised in fish pond farms, from where it accidentally occurs in natural water reservoirs, with no cases of natural reproduction registered so far /
21. Grass carp / trout fish species raised in fish pond farms, from where it accidentally occurs in natural water reservoirs, with no cases of natural reproduction registered so far /
22. Rainbow trout / fish species raised in fish pond farms, from where it accidentally occurs in natural water reservoirs, with no cases of natural reproduction registered so far/.

Despite the abovementioned, during field surveys conducted for this assessment, no fish species were detected in the area envisaged for the creation of the reservoir. Acording to locals, there is almost no fish in the area, and even if they occur – it is very rare during the floods.

6.7. Historical and cultural environment

Armavir marz is rich with monuments of history and culture. Those monuments represent all types of monuments with secular and spiritual functions known in the region. Those are ancient settlements, Stone age shelters, medieval villages, defensive, spiritual, economic constructions, cemeteries, pillars, cross-stones, etc. Chronologically they belong from ancient to modern times.

At the same time, it should be mentioned, that according to the RA Government decrees 1589-N dated on 03. 10. 2002, and N 456-N dated on N 12 04 2007, in the territories of Dalarik and Lernagog communities there are not registered historical and cultural monuments.

6.8. Specially protected nature areas and natural monuments

There are no specially protected areas of nature in the immediate vicinity of the area requested for Mastara reservoir. The closest – Vordan Karmir (Carmine) state reserve is located 28 km away from Mastara reservoir.

Vordan Karmir (Carmine) state reserve was established in 1987. It is situated in Ararat valley – in Metsamor basin. Its area covers a small section of saline ecosystems – with 219.85 ha area, on the altitude of 835-850m a.s.l.

The main objective of the reserve activity is to provide sample halophyte (saline) ecosystems of Ararat valley. The special protected object of the reserve is Armenia's endemic valuable insect - Armenian Cochineal, living on mangrove grass and reed plants. The reserve is the lasto resort of almost disappeared salien assemblages of Ararat valley, the protection of which is of big importance for protection of biodiversity also on international level.

Another category of protected areas are **sanitary-hygienic protection zones,** regulated by the RA Government Decree of 2005 No 64-N on Criteria for Definition of Areas for Sanitary Conservation of Aquatic Ecosystems, Flow Formation, Conservation of Groundwater, and Identification of Water Protection Zones, Ecotones, and Inalienable Areas". As per the Decree, it is necessary to carry out separation of water protection zones. Nevertheless, except for a few huge drinking sources, including 22 water-catchment, 6 chlorination stations and 2 daily regulation reservoirs, other water resources of Armavir marz are actually not separated and proper maintenance isn't carried out in their regards.

Sanitary protection zones should involve all the areas envisaged for water resources conservation. These are all the vulnerable spots of water resources, which may cause ecological disturbances of water resources and cause harm to human health and welfare.

Monuments of Nature

By the RA Government Decree of August 14, 2008 number 967-N on Approving the List of Monuments of Nature of the Republic of Armenia, the list of monuments of nature in the RA territory was approved. The list includes 232 existing geological, hydrogeological, hydrographic, natural and biological monuments of nature.

The monument of nature is a natural scientific, historical and cultural object with special aesthetic value, which protection regime is defined by the provisions of Article 19 the RA Law on special protected areas of nature.

In the area requested for the Mastara reservoir and in its vicinities, there are no *monuments of nature* approved by the RA Government Decree of 14.08.2008 No 967-N on Approving the List of Monuments of Nature of the Republic of Armenia.

7. SOCIAL SURVEYS

7.1. Baseline studies

7.1.1. General information

Armavir Marz is situated in western part of the Republic of Armenia. The agricultural lands of the Marz make about 97076.1 ha or 78.2% of administrative area of the Marz, 63.5% of agricultural lands are irrigable, and they make 7.6% of agricultural lands and 31% of irrigable lands of the Republic.

Armavir Marz population makes 8.9% of the population of the Republic. 31.7% of the Marz population are urban and 68.3% - rural residents[6]. The geographic location of the Marz and its climatic conditions are favorable for horticulture, viticulture, vegetable-crop production, as well as for cattle, sheep and goat breeding, pig and poultry breeding.

Poverty rate in Armavir Marz in 2016 was 30%, reducing by 4.3% from 34.3% of 2002, and increasing by 0.4% from 29.6% of 2015 – it is close to the RA average poverty rate for 2016 - 29.4%.

Table 8.1. Poverty rate in Armavir Marz (%)

	2012		2015		2016	
	Poor	of whom extremely poor	Poor	of whom extremely poor	Poor	of whom extremely poor
Armavir	**34.3**	**3.4**	**29.6**	**2.1**	**30.0**	**1.5**
RA average	32.4	2.8	29.8	2.0	29.4	1.8

Source - ASS, Social situation and poverty in Armenia, 2017

(http://www.armstat.am/file/article/poverty_2017_a_2.pdf)

7.1.2. Social and Economic Description of Communities

Mastara reservoir will be constructed on lands of Dalarik and Lernagog communities providing gravity irrigation water for Myasnikyan, Khanjyan, Lukashin, Hatsik, Noravan and Norapat communities. To evaluate the Project social impact, surveys were carried out in 8 affected communities, including 6 beneficiary communities.

Affected communities – Dalarik, Lernagog, Myasnikyan, Khanjyan, Lukashin, Hatsik, Noravan and Norapat, are in Armavir Marz, 45-65 km far from the capital, and are mainly involved in agriculture and livestock farming. In some of those communities live ethnic minorities: 5% of Khanjyan community population are Yezidis, in Dalarik and Norapat there are Russians and Yezidis, in Myasnkiyan – Yezidis and Kurds, in Hatsik and Noravan – Yezidis.

In Myasnikyan there is operating wine factory and poultry farm, in Lukashin – wine factory, grass flour workshop and leather factory, in Lernagog – there is a bread factory. In all the communities, there are school, kindergarten (non-functioning in Dalarik), medical point or medical ambulance and culture house (except for Noravan), in Khanjyan there is also a library and in Dalarik there is a musical school. In Noravan there are no manufacturing enterprises, cultural and sport institutions.

In 2017, the intercommunity roads in Dalarik community were improved through the program of asphalting. In Lernagog community during the recent 3 years no state programs were implemented, the infrastructures were upgraded with benefactors' support, health and cultural programs are implemented

[6] Source – ASS, RA permanent residents number as for January 1, 2016, pages 3-4 (http://armstat.am/file/article/nasel_01.01.2016.pdf)

with the support of "Children of Armenia" Fund. In 2015, with Government funds Myasnikyan community kindergarten bathroom was reconstructed, in Hatsik community – the reconstruction of the secondary school and recommencing of fruits refrigerator was implemented; in Noravan, Norapat, Lukashin and Khanjyan no reconstruction and development programs have been implemented during the recent 3 years.

7.1.3. Dalarik and Lernagog Communities

The population in Dalarik community is currently 4,412 people, the number of households (HH) is 977 with 114 vulnerable HHs receiving social subsidies, 10 HHs with ethnic minorities, about 100 female-headed HHs. There have been no permanent migrants from Dalarik within the last 3 years, however, about 20 people temporarily migrate for seasonal works every year.

The population in Lernagog community is currently 2,380 people, the number of households (HH) is 614 with 103 vulnerable HHs receiving social subsidies, 2 HHs with ethnic minorities, about 60 female-headed HHs. About 20 HHs migrated permanently from Lernagog (from Armenia) within the last 3 years and about 50 people temporarily migrate for seasonal works every year.

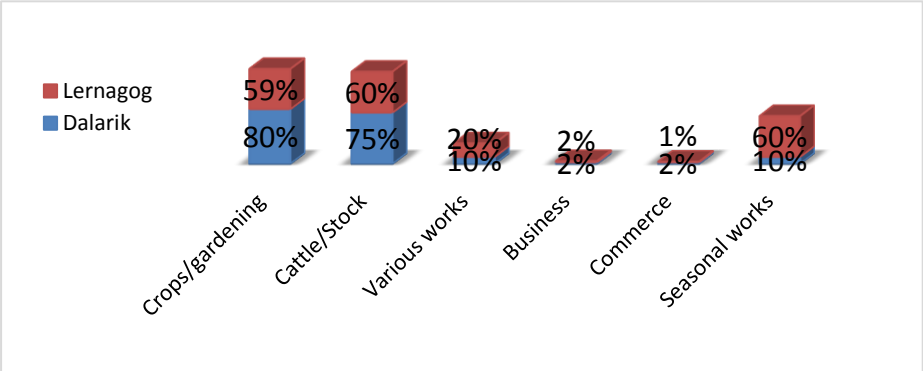
Table 8.2. Dalarik and Lernagog communities' population age and gender composition as for January 1, 2017

		Children	**Adult population (Labor age)**		**Adult population (pension age)**	
Community	**Total population**	**0-15 age group**	**16-62 age group men**	**16-62 age group women**	**above 63 years men**	**above 63 years women**
Dalarik	4412	747	1629	1615	175	246
Lernagog	2380	491	845	835	95	114

Source: Data provided by the communities

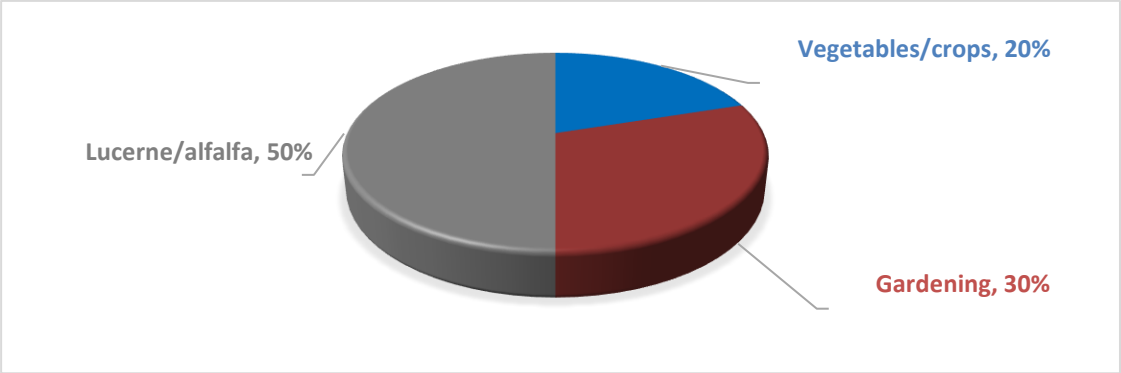
Dalarik community has 3,500ha of lands with 1,500ha of arable lands. Only 47% (700ha) of arable lands was irrigated in 2016. The main reason for not irrigating the lands is irrigation water shortage. Lernagog community has 2,280ha of lands with 1,100ha of arable lands. Only 4% (40ha) of arable lands (household plots) was irrigated in 2016. The main reason for not irrigating the lands is the poor condition of the irrigation network and the secondary canal; the tertiary network also needs rehabilitation.

About 80% of Dalarik community HHs are engaged in agriculture, cultivating their own lands mainly 700m^2 HH plots (the average size of private lands in Dalarik is 1.2ha). In Lernagog about 59% of HHs are engaged in in agriculture, cultivating a part of their own lands about 150m^2 HH plots (the average size of private lands in Lernagog is 0.6ha).



Picture 7.1. Dalarik and Lernagog communities' main occupation by sectors
Source: Data provided by Dalarik and Lernagog Community Administrations

About 20% of both communities' households is involved in vegetable crop production, about 30% - in horticulture and viticulture, about 50% - in cultivation of alfalfa.



Picture 7.2. Dalarik and Lernagog households' involvement in agricultural activity
Source: Data provided by Dalarik and Lernagog Community Administrations

In both communities green-house agricultural goods production is not developed and modern irrigation technologies are not used; the land are cultivated through furrow irrigation method.

7.1.4. Myasnikyan, Khanjyan, Lukashin, Hatsik, Norapat and Noravan communities

Age and gender composition of six beneficiary communities' population (Table 3) and general information about households (Table 4) are presented below.

Table 7.3. Age and gender composition of the beneficiary communities' population as for January 1, 2017

		Children	Adult Population (labor age)		Adult Population (pension age)	
Community	**General population**	**0-15 age group**	**16-62 age group (male)**	**16-62 age group (female)**	**≥63 age group (male)**	**≥63 age (female)**
Myasnikyan	4,446	821	1,645	1,603	181	196
Khanjyan	2,044	427	687	641	144	145
Lukashin	2,591	425	925	973	122	146
Hatsik	2,723	420	977	1,001	143	182
Norapat	2,324	375	987	611	179	172
Noravan	1,299	198	490	503	45	63

Source: Data provided by Dalarik and Lernagog Community Administrations

Table 7.4. The number of beneficiary communities' households as for January 1, 2017 distributed as following:

Community	**HH number**	***of whom***			
		HH entitled for family subsidy	**HH with ethnic minorities**	**Female-headed HH**	**HH of Refugees**
Myasnikyan	998	105	82	45	4
Khanjyan	600	45	22	83	-
Lukashin	771	50	-	32	-

Hatsik	640	30	11	45	3
Norapat	458	18	43	20	-
Noravan	241	35	2	9	-

Source: Data provided by the Community Administrations

Table 7.5 . Number of people migrating from beneficiary communities during the recent three years (2014-2016):

Communities	**Number of migrants**	***Of whom***	
		Permanent migrants	**Temporal labor migrants**
Myasnikyan	100	25	75
Khanjyan	418	160	258
Lukashin	100	25	75
Hatsik	134	12	122
Norapat	33	12	21
Noravan	300	220	80

Source: Data provided by the Community Administrations

Beneficiary communities vary with the size of their total lands, arable and irrigated lands (Table 6).

Table 7.6 . Areas of beneficiary communities irrigable and irrigated lands

Community	Irrigable lands, ha	Irrigable lands, ha	Irrigable lands, %
Myasnikyan	1353.0	836	61.7
Khanjyan	555.5	533.5	96
Lukashin	744.2	689.4	92.6
Hatsik	1141.6	1081	89.7
Norapat	272.9	252.9	92.6
Noravan	312.5	315.6	90

Source: Data provided by the Community Administrations

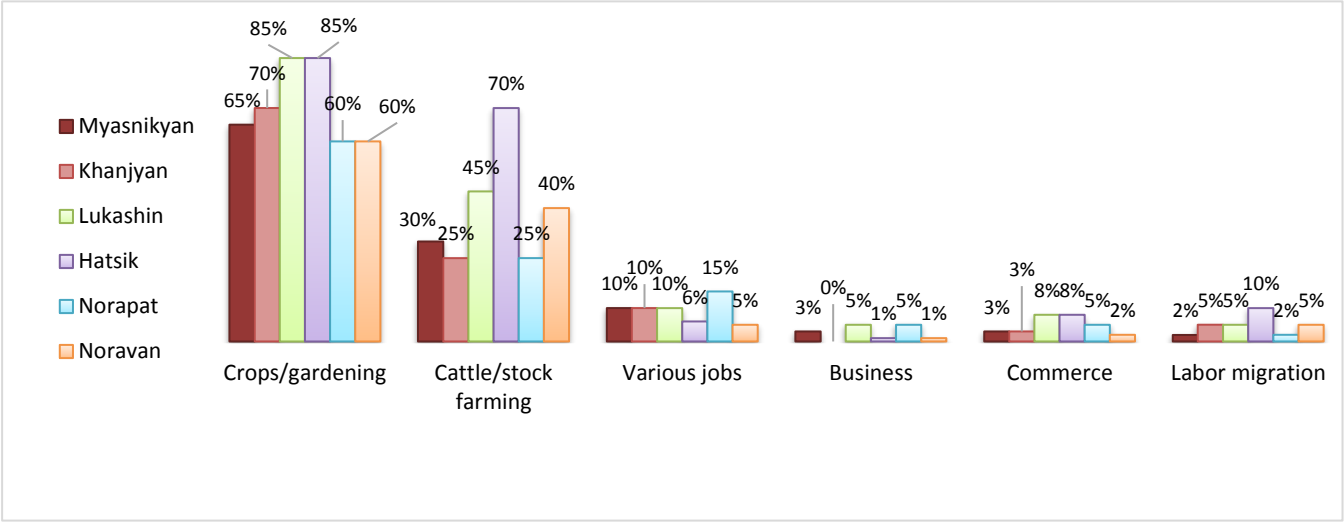
The main reasons for not cultivating the arable lands in all communities are the shortage of irrigation water, migration, unaffordability of water fees, difficulties in harvest marketing, in Hatsik – unaffordability of irrigation water in farmlands, in Noravan – non ameliorated lands, and water loss due to dilapidated tertiary network in Khanjyan.

85-95% of the beneficiary communities HHs are engaged in agriculture. Mostly vineyards, fruits, berries, vegetables, cereals and alfalfa cultivation are developed in the beneficiary communities with the use of furrow irrigation. Greenhouse production is practiced by 15% of HHs in Hatsik; only 2 greenhouses in Myasnikyan and 1 greenhouse in Norapat are cultivated with the method of drip irrigation. In Noravan and Khanjyan communities greenhouse production is not developed.

The income of HHs in the beneficiary communities is also accumulated from other sources such as:

- Trade
- Salaries

- Benefits/pension
- Business
- Transfers from abroad.



Picture 7.3. main occupation of beneficiaty communities (HHs per sector)
Source: Data provided by the Community Administrations

7.2. Interviews

7.2.1. Interviews with Community Mayors and WUA representatives

The Consultant conducted a series of qualitative studies and interviews with the Mayors of the affected communities and the representatives of the respective WUAs, as well as focus group discussions in beneficiary communities. The objective of the qualitative studies was to discuss irrigation issues in the communities, to reveal concerns and needs of different groups in the community, their expectations from the reservoir construction project.

Interviews with Dalarik and Lernagog Community Mayors

Lernagog and Dalarik community mayors emphasized the importance of Mastara reservoir construction from water resources management point of view. Although their communities will not be beneficiaries of the reservoir project due to high geographic location of their lands, the communities highly appreciate construction of the reservoir which apart from water resources economy will also have aesthetic importance, will have a positive impact on the climate and will promote creation of new businesses. They also hope that after the construction of the reservoir their communities will have extra water supply through Talin canal the load of which will lessen due to the reservation of water in the reservoir; hence, the extra water can be conveyed to Dalarik by "Shenik" WUA and to Lernagog by "Talin" WUA.

Lernagog Community mayor and deputy mayor of Dalarik almost excluded negative impact of the reservoir construction project on their communities living conditions at the construction and operation phases. At the same time they highlighted the possibility of temporal employment for their communities and its positive impact on the households.

Both Community mayors presented irrigation related issues of their communities. In particular, Lernagog mayor noted that the secondary canal conveying water to the community needs rehabilitation as the conveyed water is not enough to irrigate even 10% of the arable lands. The deputy mayor of Dalarik noted that their tertiary network needs rehabilitation although "Shenik" WUA regularly conducts small renovation works. Due to irrigation water shortage only 68% of arable lands is cultivated.

Interviews with Myasnikyan, Khanjyan, Lukashin, Hatsik, Norapat and Noravan Community Mayors

In their interviews the mayors of the beneficiary communities highlighted the importance of Mastara reservoir construction for water resources management and ensuring irrigation water supply to their communities. They noted that some parts of their agricultural lands are not irrigated because of insufficient irrigation water as well as due to dilapidated tertiary networks or soil-ground canals and big loss of water.

The communities have land leasing system and according to the communities leaders any person on equal competitive principle can sign a Lease Agreement with the municipality and start cultivating the leased land. Presently in Noravan 23ha of leased land is cultivated, in Khanjyan 45ha, in Norapat 32.5ha, in Myasnikyan 39ha, however, there are limitations for land leasing in Myasnikyan because of water shortage. Hatsik community has 102ha of land for lease, 92ha is leased. The community leader noted that the reasons for unwillingness to cultivate the land are remote location of the lands for lease from the residual area, low access to irrigation water, big investments to fertilize the land and other expenses.

The Community mayors have positive expectations from the reservoir construction project. According to them the reservoir construction will significantly contribute to improvement of social-economic conditions of the beneficiary communities and livelihoods of HHs. In Myasnikyan additional 1,200ha of land, in Noravan all arable lands. In Norapat the irrigation water is expensive as it is pumped out from deep wells, so the community leader hopes the construction of the reservoir will result also in water fee decrease for water users in their community and increase in profits. Khanjyan village mayor expects the reservoir will provide them with permanent and sufficient water amount during the whole irrigation season contributing to drastic increase in crops productivity and essential growth of HHs living standards. However, the mayors had also concerns if the water gathered in the reservoir will be sufficient for all their lands assuming that the upstream communities will use water more generously and the downstream communities will not receive the required quantity of water.

The Community mayors noted that given the fact that some women conduct agricultural day-pay works in the nearby communities or in their own community, the construction and efficient operation of the reservoir will improve women's work conditions as they will cultivate their own lands, the number of labor migrants will decrease; the majority of labor migrants will remain in their communities once the irrigation scheme starts its efficient operation. The community leaders excluded significant negative impacts related to the reservoir construction on the community or any household.

The Community mayors appreciated the fact that the construction contractor will provide temporary employment to local workforce. They believed there will be lots of people looking for a temporary job.

They expressed their readiness to actively participate in the reservoir design development process and in public discussions as the project stakeholders.

Interviews with WUAs' Representatives

Irrigation water supply to the affected and beneficiary communities is provided by "Talin", "Shenik" and "Armavir" WUAs. The Consultant had interviews with WUAs' representatives to study issues related to irrigation networks of the affected and beneficiary communities and to reveal possibilities of providing additional irrigation water to the communities.

Table 7.7. Number of water users in affected and beneficiary communities

Community	**WUA**	**Number of water users**
Lernagog	Talin	200
Dalarik	Shenik	245
Myasnikyan	Shenik	385

Khanjyan	Armavir	822
Lukashin	Armavir	834
Hatsik	Armavir	919
Norapat	Armavir	1,121
Noravan	Armavir	658

Source: Data provided by WUAs

"Talin" WUA has 200 water users in Lernagog community and provides irrigation water to 18ha of land, 13ha is irrigated by gravity scheme and 5ha by mechanical scheme.

The WUA representative noted that they had tried to meet irrigation requirements of water users in Lernagog but it was impossible because of water shortage. Water supply interruptions are also connected with the location of Lernagog community; it's the farthest community served by the WUA. He also explained that irrigated areas in Lernagog community are mostly household plots. The irrigation is implemented through a closed network supplying water to 30-40 HHs which makes water measurement and distribution process very difficult. Highlighting the significance of the reservoir construction he noted that probably Talin WUA will manage to provide more water to Lernagog community especially in the pick of irrigation season through additional waters.

"Shenik" WUA has 245 water users in Dalarik community and it provides irrigation water to 614ha of land by gravity scheme, 385 water users in Myasnikyan community providing water to 425ha of land.

The WUA representative noted that irrigation water was mostly provided to water users without interruptions within the last 3 years except the year 2016 which was a low-water years and the WUA had difficulties with water supply. In his words operational disorders in the irrigation scheme are urgently eliminated to ensure irrigation water supply to water users. He explained that water distribution is conducted according to time schedule, the water user's contract and water demand of the irrigated crop. He also added that during low-water years all water users receive less amount of water; water demand is not satisfied due to water loss as well. According to the WUA representative after the construction of Mastara reservoir Myasnikyan community will manage to cultivate 590ha of lands which are currently not-irrigated, besides Myasnikyan, being the last community of the irrigation scheme, will have regular water supply.

"Armavir" WUA representative noted that the WUA provides irrigation water to 2,704ha of land; 672ha of land is irrigated by a mechanical scheme. Although the beneficiary communities complained of irrigation water supply interruptions or water shortage, the WUA representative claimed that water users received sufficient amount of water with some delays. He also added that during low-water years all water users receive less amount of water; water demand is not satisfied due to water loss as well. According to him due to the reservoir construction in hot weather it will be possible to improve water supply to the last communities of the scheme and to decrease the use of mechanical method.

In his words operational disorders in the irrigation scheme are urgently eliminated to ensure irrigation water supply to water users. He explained that water distribution is conducted according to time schedule, the water user's contract and water demand of the irrigated crop.

According to the WUAs' representatives the reservoir construction will have only positive impact on the region solving irrigation issues of 6 communities, improving irrigation possibilities of 2 communities and promoting fish production and entertainment businesses.

7.3. Focus Group Discussions

The Consultant with the support of 6 beneficiary communities' administrations organized and within the second month of the consulting services conducted 2 FG discussions in each community with different target groups: big and small farmers, ethnic minorities and vulnerable groups.

Table 7.8. Number of Focus Group Discussions Participants by communities

Community	Women	Men
Myasnikyan	6	12
Khanjyan	9	7
Lukashin	6	9
Hatsik	8	7
Norapat	5	8
Noravan	8	7
Lernagog	6	7
Dalarik	7	9

The structure and general description of FG discussions participants are presented in Table 9.

Table 7.9. The structure and general description of FG discussions participants

Community	Women	Men
Myasnikyan	**Participants** -6, including 1 representative of ethnic minority (Yezidis) **Age** – 35-68 **HH members -** 2-7 **Marital Status** –married-4, single–1, widow-1 **Main Source of HH income** – agriculture (4 participants), pension (3 participants), jobs (3 participants), money transfers (1 participant)	**Participants** -12, including 3 representatives of vulnerable groups **Age** – 41-80 **HH members -** 3-7 **Marital Status** –married-5, widower-1, single-6 **Main Source of HH income** – agriculture (5 participants), jobs (10 participants), subsidy and pension (7 participants), commerce (3participants), money transfers (5 participants)
Khanjyan	**Participants** -9, including 2 representatives of vulnerable groups **Age** – 25-64 **HH members –** 3-6 **Marital Status** –married-5, widow-3 **Main Source of HH income** – agriculture (7 participants), subsidy (2 participants), pension (5 participants), jobs (3 participants), commerce, money transfers (1 participant)	**Participants** -7, including 1 representative of vulnerable groups **Age** – 36-62 **HH members –** 4-6 **Marital Status** –married **Main Source of HH income** – agriculture, jobs, (1 participant)
Lukashin	**Participants** -6, including 2 representatives of vulnerable groups, 1 representative of ethnic minority (Yezidis)	**Participants** -9, including 1 representative of and 2 representatives of vulnerable groups **Age** – 29-78

	Age – 24-71 **HH members –** 1-7 **Marital Status** –married-3, widow-2, single-1 **Main Source of HH income** – agriculture (6 participants), jobs (3 participants), subsidy or pension (4 participants), money transfers (2 participants)	**HH members** – 2-6 **Marital Status** –married-6, single-2, widower-1 **Main Source of HH income** – agriculture, jobs and commerce (4 participants), pension (1 participant), money transfers (2 participants)
Hatsik	**Participants** -8, including 2 representatives of vulnerable groups **Age** – 28-61 **HH members –** 3-6 **Marital Status** –married-7, widow-1 **Main Source of HH income** – agriculture (6 participants), jobs and commerce(6 participants), subsidy and pension (4 participants), money transfers (2 participants)	**Participants** -7 **Age** – 28-68 **HH members** – 3-6 **Marital Status** –married-5, single-2 **Main Source of HH income** – agriculture, jobs and commerce (4 participants), pension (1 participant)
Norapat	**Participants** -5, including 1 representative of vulnerable groups **Age** – 24-67 **HH members –** 3-6 **Marital Status** –married-3, widow-1, single-1 **Main Source of HH income** – agriculture (4 participants), jobs and commerce(3 participants), subsidy and pension (2 participants), money transfers (1 participant)	**Participants** -8, including 2 representatives of ethnic minority (Yezidis) **Age** – 33-71 **HH members –** 2-8 **Marital Status** –married-6, single-2 **Main Source of HH income** – agriculture (6 participants), jobs and commerce (4 participants), pension (2 participants), money transfers (2 participants)
Noravan	**Participants** -8, including 2 representatives of vulnerable groups **Age** – 32-71 **HH members –** 2-7 **Marital Status** –married-7, widow-1 **Main Source of HH income** – agriculture (6 participants), jobs and commerce(6 participants), subsidy and pension (4 participants), money transfers (2 participants)	**Participants** -9 **Age** – 26-67 **HH members** – 3-7 **Marital Status** –married-5, single-2, widower-2 **Main Source of HH income** – agriculture, jobs and commerce (4 participants), pension (1 participant)
Lernagog	**Participants** -6, including 1 representatives of vulnerable groups **Age** – 29-73 **HH members – 3**-5 **Marital Status** –married-4, single-1, widow-1 **Main Source of HH income** – agriculture (4 participants), jobs and commerce(5 participants), subsidy and pension (4 participants), money transfers (2 participants)	**Participants** -7, including 1 representatives of vulnerable groups **Age** – 31-69 **HH members** – 2-6 **Marital Status** –married-5, widower-2 **Main Source of HH income** – agriculture (6 participants), jobs and commerce (5 participants), pension (2 participant)

Dalarik	**Participants** -7, including 1 representative of vulnerable groups **Age** – 23-68 **HH members –** 3-6 **Marital Status** –married-5, widow-1, single-1 **Main Source of HH income** – agriculture (6 participants), jobs and commerce(3 participants), subsidy and pension (3 participants), money transfers (1 participant)	**Participants** -9, including 1 representative of ethnic minority (Yezidis) **Age** – 33-72 **HH members –** 2-5 **Marital Status** –married-6, single-2, widower-1 **Main Source of HH income** – agriculture (7 participants), jobs and commerce (6 participants), pension (4 participants), money transfers (2 participants)

FG Discussions in Beneficiary Communities

During FG discussions women of the beneficiary communities expressed their positive attitude and expectations from Mastara reservoir construction project. According to them water access will promote development of agriculture enhancing land cultivation and gardening as well as increasing number of people engaged in cattle breeding. In Noravan women's opinion after the construction of the reservoir there will be a drastic decrease in the number of labor migrants and young people leaving the community. In Khanjyan women's opinion after the construction of the reservoir they will have more chances of doing agriculture and getting profit. Regular water supply will enable people to cultivate high efficiency crops – apricots, plums, peaches, grapes, watermelon and vegetables. They noted that production of own crops will somehow improve living conditions of HHs and will moderate poverty level. They also supposed that the project will promote the development of cattle farming as there will be a chance of cultivating forage. In their words water is equally distributed in water users even sometimes women water users are more privileged. Myasnikyan community women noted that female headed HHs have some priority in water use in the day-time shift.

During FG discussions men of the beneficiary communities noted that agricultural profit alone does not cover livelihood needs of their households. They are unable to cultivate all their land because of water shortage, poor condition of the tertiary network and low quality of the land. Khanjyan farmers complained of extremely bad water supply within the last year which compelled them to sometimes use drinking water in their plots not to lose their crops. In their words with the improvement of water supply after the construction of the reservoir they will start cultivating new crops on non-irrigated which will result in growth of profitability and will improve living conditions of HHs. They noted that very few people might be doing day-pay works from their communities while lots of people come to their communities in search of work. Hence the development of agriculture will enhance opportunities for day-pay work. They supposed there will be decrease in the number of labor migrants with the increased agricultural profitability. They highlighted the fact that tertiary networks need rehabilitation; they also proposed that small water pools in communities will contribute to introduction of new irrigation technologies. Myasnikyan community farmers noted that with water availability the WUA needs to regulate water distribution in farmers. Currently the water is insufficient for the community so the land plots located near the canal manage to completely irrigate their lands. Hatsik community farmers noted that water loss rate is high in their community due to poor condition of the tertiary network. Norapat community farmers noted that their community does not get water through the gravity scheme. The lands are irrigated with the water pumped out from deep wells which is more expensive than irrigation water although its qualities are lower than those of irrigation water.

The representatives of ethnic minorities (Yezidis) participating in FG discussions in all communities noted they do not face any discrimination with land and water use. According to all participants the construction of the reservoir will not have any negative impacts or problems. They expect their HH members will have temporal employment opportunity at the construction phase.

The representatives of vulnerable groups participating in FG discussions in all communities noted they have difficulties with land cultivation because of limited resources and fear to lose crops due to water shortage. The perspective to have regular water supply from the reservoir invigorated them.

FG Discussions in Affected Communities (Dalarik and Lernagog)

During FG discussions the participants of all groups in the affected communities expressed their opinion about the MRP. According to them the positive aspect of the project is the climate and scenery change in their region that will make the drylands look more appealing. However, they regreted that their communities are not among the project beneficiaries. They highlighted their own irrigation problems. According to them the shortage of water is the main reason they are unable to cultivate their lands properly and to gather valuable harvest. They also noted that it is impossible to earn their living on agriculture alone.

In Dalarik both women's and men's FG discussions participants expressed their hope that the situation might improve a little if Shenik WUA, responsible for their irrigation water supply, direct additional quantity of water to their community as a result of the project. Women FG participants in Dalarik noted additional water will promote the development of agriculture in their community with positive influence on quality and quantity of agricultural products.

In Lernagog both women's and men's FG discussion participants claimed that irrigation water supply in Lernagog is hardly enough to partially cultivate their household plots mostly growing agricultural products for their own use. Women FG participants in Lernagog also noted that due to lack of water they are unable to cultivate their fields/lands so there are many women going for a day-pay agricultural works to other villages. Men FG participants in Lernagog doubted if Talin WUA will increase the amounts of water directed to their community as their community is the last one in that is fed by Talin canal and very often the water reaching their community is not sufficient to fully cultivate HHs plots.

According to all participants the construction of the reservoir will not have any negative impacts or problems on their HHs and on their communities. They noted that it will have a positive impact on the HHs that own lands in the reservoir area as they will get compensation for the lost lands, which are not used currently. They expect their HH members will have temporal employment opportunity at the construction phase. The representative of ethnic minorities (Yezidis) participating in men's FG discussion in Dalarik noted that ethnic minorities face the same agricultural problems as the whole community. He added there is no discrimination with land and water use. The women participants of both communities said that women headed households do not have any disadvantages during irrigation water distribution. The representatives of vulnerable groups (poor households) participating in FG discussions in all communities noted they have difficulties with land cultivation because of limited resources.

7.4. Temporary and Permanent Land Use

When preparing the preliminary design of Mastara reservoir, the Consultant tried to reduce to the extent possible the land acquisition and resettlement impacts. The preliminary assessment of land acquisition and resettlement impacts in this stage has been implemented based on preliminary data on the affected communities acquired from the RA State Committee of Real Property Cadaster. The Resettlement Actipn Plan (RAP) will include outcome of screening impacts on land plots. This may change after detailed design is ready but will probably not change substantially. 36 affected land plots have been identified, out of which 4 are State property, 9 are community property and 23 are private property. The received data on lands were verified during the meetings with the affected Community Mayors. The available data were completed with details received from statistical sources, as well as with preliminary data collected during the site works (for example – the existence of buildings, trees, their total number, etc.). Based on the preliminary land acquisition and resettlement (LAR) assessment, the Project will permanently acquire 68.630 ha of land plots according to FSL at 950m of which 2.465 ha of state lands (1.255 ha in Lernagog and 1.210 ha in Dalarik), 12.881 ha of community lands (2.618 ha in Lernagog and 10.263 ha in Dalarik), and 55.284 ha of private lands (43.096 ha in Lernagog and 10.188 ha in Dalarik). According to FSL at 951.5m design option the Project will permanently acquire 75.303 ha of land of which 2.806 ha of state property (1.029 ha in Lernagog and 1.777 ha in Dalarik), 14.629 ha of community lands (1.280 ha in Lernagog and 13.349 ha in Dalarik), 57.868 ha of private lands (46.544 ha in Lernagog and 11.324 ha in Dalarik).[7]

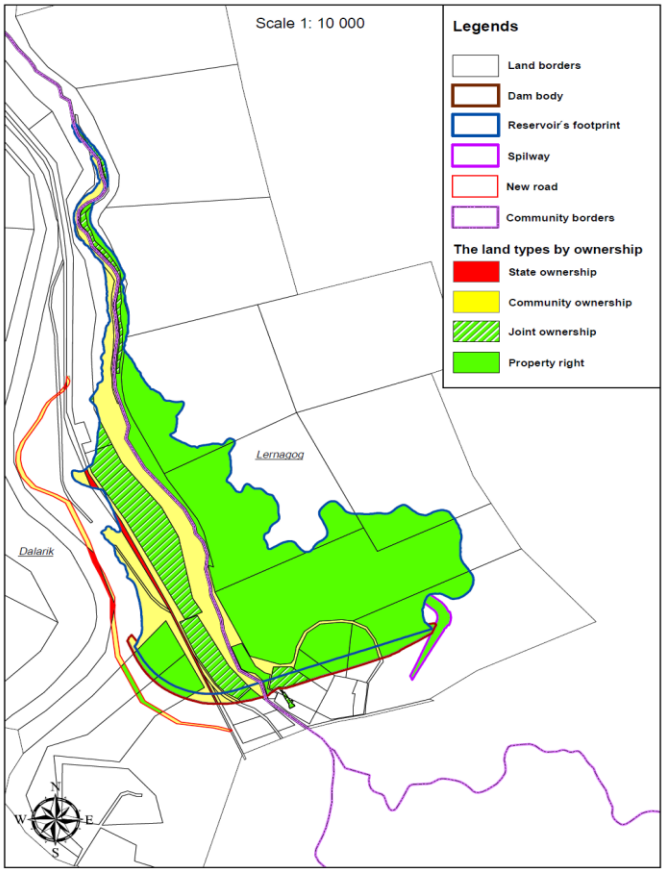


Image 8.4. Mastara Reservoir land plots as per ownership status FSL at 951.5m)

During construction, the contractor should avoid the use of other private lands. Particularly, for construction camps only community lands or leased lands can be used. Nevertheless, some non-envisaged circumstances and obstacles may make the construction contractor face the private lands use problems which had not been envisaged by the design. In such cases, the construction shall immediately be stopped and the project implementing entity shall initiate the design modification works through the Design Consultant and prepare RAP.

[7] This data present land acquisition volumes required for the construction of the reservoir, new road and the diversion pipeline.

8. ENVIRONMENTAL AND SOCIAL IMPACTS OF MASTARA RESERVOIR CONSTRUCTION PROJECT

8.1. Positive and negative impacts

Mastara reservoir construction will have positive impacts on irrigation water supply of the 6 beneficiary communities. It will provide irrigation water to 4,432 water users irrigating about 4,384ha of land with a gravity scheme. Besides irrigation water is more favorable to crops with its qualities than artesian water which is currently used in some of the beneficiary communities.

The reservoir construction will increase irrigation water supply reliability which will promote cultivation of more profitable crops. The expected positive social impacts of the project will be long-term by their nature and will contribute to improvement of social and economic conditions in the affected region.

In a result of implemented works, there will also be positive changes in climate terms – the existing water basin will mitigate the climate change and promote the enrichment of biodiversity.

8.2. Environmental impacts during construction of reservoir, diversion pipeline and alternative road

During construction phase, there might be some negative impact on the environment, such as surface and underground water resource pollution, degradation of lands and landscape, land erosion, which may be a result of excavated/extracted earth, improper removal/placement of the disposed soil and construction waste, leakage of fuels and lubricants and other materials during the construction, use of temporary construction site (const. camps, car parks, storages, etc.), temporary pollution of the air caused by the intense traffic schedule of trucks during construction, noise and vibrations during the excavation work, as well as potential impacts on the vegetative cover.

Potential environmental and social impacts during the construction phase are presented below.

(a) Ambient air pollution

In construction phase in a result of excavation-loading works, emissions of inorganic dust occur. During operation of construction machinery and transport, the emissions of dust /during traffic/ and smoke gases during diesel fuel combustion occur. During welding, welding aerosol and manganese oxides emerge. Concrete mixers are installed for concrete mixing, the operation of which results in cement dust emissions.

Main sources of emissions are presented below:

- Inorganic dust emissions during excavation-loading works;
- Emissions during operation of construction machinery and traffic;
- Emissions during preparation of concrete mixtures;
- Gasoline fumes;
- Emissions during welding;
- Air pollution during excavation and loading, as well as during operation of construction machinery;
- Pipeline clogging and water leakage from the system during operation.

The construction works will be implemented on a significant distance from residential area, the harmful substances may not affect the air pollution in settlements.

Noise and vibration

Significant increase in noise levels is expected during construction and transportation activities, in particular, during the earth works, pneumatic drilling, cranes operations, equipment installation. Due to the sparsely populated area, for a largest part of the construction area noise during construction activities will be low.

The construction contractor will take reasonable steps to manage and control noise from all equipment. Workers will wear ear protection devices as part of their PPE if they are exposed to high noise levels.

(b) Pollution of soil and water resources with construction run-off

Various risks to water and soil quality could arise from sources of pollution during construction including spillage of fuels, lubricants and other toxic materials at the construction site, discharge of silt laden run off from sites, and the inadequate treatment and disposal of waste and wastewater from worker facilities.

Materials such as oil, diesel fuel, concrete additives, and solvents are likely to be stored and used on construction sites and lay down areas and in construction traffic and equipment. Storage and handling of these materials could lead to spills on site, along roads and in surrounding areas. Contaminated run-off from spill sites could adversely affect soils and vegetation and if it reaches the river would have an adverse impact on water quality. The extent of impact will depend on the size, frequency and timing of spills in relation to flow conditions in the receiving waters and the nature of the materials involved including their toxicity and possible for biomagnification or bioaccumulation. The risk of water pollution for these sources can be reduced by adopting protective measures to prevent spills and putting in place suitable spill response plans to be implemented in the event of accidents occurring. Suitable measures to collect treat and dispose of chemical wastes will also be required. With these good construction site practices the risk of water pollution from spills and waste should be minor.

(c) Environmental impacts on water resources during construction of reservoir

Activities associated with dam construction including clearance of vegetation, stream crossings, operation of large equipment and equipment lay down, can lead to significant soil disturbance at construction sites, resulting in soil erosion and/or compaction, degradation of affected areas and pollution of receiving watercourses.

The risks of soil erosion and degradation can be significantly reduced by adoption of good construction site management practices, such as establishment of vegetative buffer zones, slope stabilisation, protection of soil storage areas, controlled site drainage and use of sediment traps. With suitable mitigation the impact of sediments on water quality is judged to be minor.

Inappropriate disposal of waste and wastewater from camps would also have negative effects on water quality. The extent of impact will depend on the location of discharge points and the dilution possible of receiving waters. Impacts in nearby water bodies, could include reduction in dissolved oxygen levels, nutrient loading causing increased algal growth, and the spread of pathogenic disease vectors.

(d) Water use and drainage

During construction works, water is used for drinking purposes of administrative staff and workers, for domestic/economic purposes, as well as for watering of construction sites and vehicle maintenance.

Water intake is planned from the Dalarik community water supply system on a contractual basis.

The construction contractor will develop water use and drainage norms to be submitted to the Ministry of Nature Protection of the Republic of Armenia. The Ministry will verify the substantiation of the water requirement specified in the draft norms to ensure provision of adequate water amount from the intended water intake and will issue water use permit. Agreement with the local community for water intake will be signed upon issuing of water use permit.

Water for watering purposes will be brought by water tanks, and drinking water will be brought by special containers.

During construction phase, household wastewater will be collected in wastewater collection pit constructed with impermeable materials, which should be moved along the construction site. Based on the calculated wastewater volumes, it is planned to construct 50 m^3 net volume pit, which will provide 7-day work. It is planned to export once a week the contents of the pit with special vehicles to the sewage collector agreed with local authorities.

The abovementioned impact will be temporary, and will be mitigated in a result of timely and proper implementation of measures mentioned in Annex A – Environmental and Social Management Plan.

(e) Impacts on biodiversity during construction of diversion pipeline and alternative road

Water pipeline laying and trenching works carried out in Dalarik and Lernagog communities, may have temporary negative impact on the earth cover and natural vegetation within the irrigation system corridor due to surface disturbance and storage of excavated material till its backfilling. Earth works will require clearing of vegetation along the pipeline corridor, including removal of shrubs. Cutting of vegetative cover and storage shall be carried along the trench area. The soil and the topsoil shall be placed separately. The excavated soil conservation until backfilling may damage the soil cover. Before the implementation of earth works, the vegetation along the pipeline corridor shall be cleared, including removing of shrubs. Disposal of excess material and waste may also lead to disturbance of wildlife, including impacts on habitats.

Cutting and storing of vegetative cover shall be carried along the trench area. The soil and the topsoil shall be placed separately. During the earthworks the topsoil to be preserved is estimated to be 1900m^3, and the costs related to the preservation and rehabilitation of the areas - up to AMD 8mln.

According to the botanical researches the plant species in project areas are not included in RA Red Book of plants.

(f) Extraction of construction materials

Aggregates required for construction will be preferably obtained through the licensed providers from the already licensed and operational quarries.

However, Contractor will have a free choice and may wish to open an own quarry, in which case the risks of landscape degradation, erosion, loss of a natural site's aesthetic value, damage to aquatic life (in case of extraction from a river bed), deterioration of water quality, and stimulation of erosion of river banks may arise. If this is the case, the potential sites where quarries may be located will be assessed and ESIA documentation including ESMP will be submitted for state environmental expertise to obtain exploitation license as required by national legislation.

(g) Generation of construction waste

The various wastes generated as a result of planned construction at the affected areas may have an adverse impact on the environment, particularly cause change in landscape, pollute water and earth resources, ambient air, as well as affect human health.

Earth works will generate modest amount of excess material, because most of the excavated earth and topsoil will be used for backfilling. The areas where the pipeline is laid and which are covered with vegetation, may contain grasses and bushes, which are wastes as well and those shall be removed from the construction site. Other types of waste, typical for general construction activities, are also expected in moderate amounts, and may include empty metallic and plastic containers, construction wastes, household waste from the work camp(s) or yards, as well as certain amount of hazardous waste such as fuel and lubricants, paints, solvents, machinery filters, batteries and tires.

(h) Impacts on aquatic ecology during construction of reservoir

When construction is completed and the reservoir begins to fill, the biological communities in the reservoir will begin to acquire lacustrine characteristics. Species that prefer shallow habitat are likely to colonise the periphery of the reservoir, and others that require moving water will disappear or persist as relict populations in the headwaters of the reservoir. Sediment retention and subsequent deposition within the reservoir will cause most of the coarse substrate, rocky outcrops and other elements of the riverbed to progressively disappear under layers of silt transported from upstream. This will alter the fish and macroinvertebrate composition with a reduction in the abundance of riverine fishes and an increase in algal feeders.

There may also be short term effects downstream during construction as a result of mobilisation of sediments around construction activity caused by soil disturbance and erosion. This could increase sediment loads downstream of construction, particularly during the wet season leading to increased turbidity and sedimentation downstream.

(i) Impacts on terrestrial habitats during construction of reservoir

Development of the reservoir will reduce the availability of terrestrial habitat, increasing competition between terrestrial wildlife for limited resources in a smaller land area. The presence of a permanent body of water will increase the value of terrestrial habitat near the shore, thereby partially offsetting the adverse impact of habitat loss. On balance the significance of this effect is judged to be moderate.

(j) Temporary mipacts on wildlife during construction of reservoir

Dam construction and inundation may result in the short term disturbance of terrestrial wildlife in the vicinity of construction sites, temporary access roads and worker camps.

The extent of impact will depend on the size and location of the camp but is expected to be of medium short term significance. Restoration of the site after construction should enable re-establishment of suitable habitats.

8.3. Social impacts at construction stage

Construction-related temporary impacts

(a). Increased traffic

A short-term increase in traffic is expected in the communities related to the movement of construction vehicles and operation of machinery. This could disturb the peaceful life of the local communities and sometimes block the roads.

(b). Blocked access

Lack of access to or inconvenience for people to get to their homes, fields, assets caused by construction camps and machinery location or construction activities.

(c). Increased noise and dust

The operation of machinery will generate noise and dust, which might cause health problems in the communities.

(d). Increased health problems

Potential harm to the health of workers resulted from low quality and improper use of construction materials.

(e). Accidents at construction site

Accidents caused by violation of work safety rules can cause physical injuries to people at the construction site sometimes with fatal results.

(f). Risk and impacts of labor influx

141 persons will be involved in the construction works, on both engineering/management and field positions. Based on previous experience, it can be assumed that the tender will be international, however a large number of workers could be from local communities. The exact number of migrant workers will be determined after selection of the construction contractor. All project workers – direct and contracted including sub-contractors, if any – will develop and adopt a Code of Conduct acceptable to PIU and the relevant donor organization. Contractors would also be required to develop a detailed (Community Engagement, Health and Safety) plan including measures to prevent and manage social risks related to labor influx (including but not limited to strain on local services, diseases, gender-based violence, use of security services, etc.) Such plans will include mechanisms for raising concerns or grievances with contractor as well as PIU and will foresee sanctions in the event that provisions of the plan are not being followed.

(g) Cultural heritage

The state list of immovable monuments of history and culture in the Armavir Marz has been approved by the Government Decree No 0389-N of 03.10.2002 and Decree No 456-N of 12.04.2007. In the above mentioned two lists, there are no registered historical and cultural monuments in the territories of Dalarik and Lernagog communities. However, representatives of the Agency of Protection of Monuments will accompany the design/construction contractor during the detailed design phase and determine the exact routing of water pipeline and alternative road according to their requirements. Same procedure will be applied for location of other design elements.

In case during construction work historical-cultural monuments or other cultural materials are discovered, the Contractor will immediately interrupt the work and present a corresponding report to the State agency for protecting historical-cultural monuments. The specialists of the agency will study the discovered material and give their professional conclusion, based on which the works will either go on, or the design will be reviewed.

Temporary land use impacts

A Resettlement Action Plan (RAP) has been developed under the MRP addressing all issues of private land acquisition and resettlement. Nevertheless, during works implementation, permanent and/or temporary use of community lands is also envisaged (for piling the extracted soil to backfill later after the pipeline installation, etc).

Temporary local employment

(a) The positive social impact of the construction phase is the temporary employment opportunity for local non-qualified labor. About 80% of the workforce will be local people. These will mostly be workers and drivers.

(b) However, there is a risk that women will not have the same opportunity of temporal work, as traditionally women do not work in construction in Armenia.

Irrigation water supply interruption

Construction works implemented during irrigation season can have social-economic impact on affected communities causing water supply interruptions in the irrigation schedule and damage of crops.

Construction camps

Construction camps must be located on free community area, which shall be arranged with the community in advance to avoid use of private lands. However, if unused communal lands are not available, the contractor can sign a lease agreement with the community who owns the land, and will offer respective compensation to the users of the land for any losses of crops, trees, or assets.

The adverse impacts on the communities affected by the program implementation, are basically related to construction operations, and have temporary and short-term impacts. These impacts may be avoided or minimized by the effective implementation of the social impact mitigation measures and environmental measures of this report ESMP which shall be followed by the construction contractors, technical supervision and design consultants as well as other supervising entities.

8.4. Environmental Impacts at Operation Stage

8.4.1. Impacts on Reservoir Water Quality

Turbulence increases gas exchange between the existing river and atmosphere, but this process would no longer occur in the more static reservoir. Increased temperatures in the reservoir would also decrease the capacity of the water to maintain oxygen in solution compared to the river. Together these effects will all

contribute to reduced dissolved oxygen levels in the water impairing reservoir water quality in the short term and leading to long term dissolved oxygen levels lower than those in the existing river over the long term. Organic decomposition under anaerobic conditions at the bottom of the reservoir may also lead to anoxic conditions and the production of hydrogen sulphide, presenting risks of production of noxious odours and damage to aquatic organisms in the reservoir and downstream.

The extent of these impacts will be determined by the detailed characteristics of the reservoir, including its circulatory patterns, temperature profile, and water chemistry, however, it is understood that organic decomposition is unlikely to have a major influence on the water quality conditions in the reservoir, and this impact is judged as likely to be of low to moderate short term significance.

In addition, sediment will accumulate in the reservoir, but there would appear to be little or no risk of reservoir failure to sediment input from the river.

The analysis shows that no impact on water quality is envisaged during operation provided that anthropogenic pressure does not increase considerably beyond reasonable projections and the environmental flow is consistently maintained.

8.4.2. Sedimentation and Erosion

An estimated 0.5–1% of the total freshwater storage capacity of dams is lost each year to sedimentation in both large and small reservoirs worldwide [*Keller et al, 2000, p6–7 (reference from the World Commission on Dams Report*)]. Without appropriate mitigation, such processes can have serious implications for the lifespan of dams. In addition, the release of sediment-free water from dams can have significant impacts on downstream river morphology.

Sediment could enter the reservoir as a result of changes in landuse upstream of the dam or increased erosion around the lake shore. It will be possible to mitigate the risk of increased sediment loads from these sources through management of upstream lands and the area around the reservoir.

8.4.3. Description of methodology of complex assessment of climate change impact on surface water resources

At operation stage certain changes related to the changed climatic conditions in the area will occur.

It is difficult to assess the immediate impact of the reservoir on climatic conditions of the area, therefore here an attempt was made to assess the impact of total climate change on local conditions. The working group which prepared this report selected a physical-statistical or regression model to assess the level of vulnerability of surface water resources up to years 2017-2040, 2041-2070, and 2071-2100.

River water resources vulnerability for the periods of 2018-2040, 2041-2070, and 2071-2100, has been assessed as per CCSM4 (Climate System Model 4) model data – future changes in air temperature and amounts of precipitation, developed based on emissions RCP8,5 (equivalent to previously approved A2) and RCP6,0 (B2) scenarios.

8.4.4. Water-catchment basin climatic conditions factor

The climate in the reservoir area is strictly continental. Of climatic factors, the biggest role and importance have the amounts of atmospheric precipitation and their distribution in the basin area. Due to complicated relief of basin surface, the total turnover of atmospheric precipitation distribution in the river basin is quite uneven.

The annual amount of atmospheric precipitation is characterized by large amplitude of fluctuation - 250-500mm in foothills and 750-1000mm in highland zones. It should be mentioned that the main part of atmospheric precipitation falls in May.

Snow cover is also characterized by uneven distribution. The thickness of snow cover in Ararat valley is 10-44cm and in highlands is 150-200cm. Snow cover maintenance regime in the river basin by the altitude ranges between 1.5 to 8.5 months.

The evaporation in the basin changes considerably by the altitude. It is most prominent in Ararat valley along with high temperatures also conditioned by winds.

The annual air absolute humidity course coincides with temperature course, it decreases with altitude.

8.4.5. Surface water resources vulnerability assessment up to years 2018-2040, 2041- 2070 and 2071-2100

Over the last decades, the interest in water resources survey, their inventory and assessment, rational use and preservation increased significantly. This is due to the development of global economy, the increase in demand for fresh water, as well as global warming.

In case of possible climate change, the assessment of water resource vulnerability and implementation of adaptation measures are important for the sustainable development of the Republic's economy and improvement of population's living standards.

8.4.6. Assessment of Air Temperature and Atmospheric Precipitations

For the assessment of changes in air temperature and atmospheric precipitation amount, the data of Armavir meteorological station were used, which describe the temperature and humidity general patterns in the area of Mastara reservoir.

Table 8.1. Armavir meteorological station 1991-2016 average air temperature (^{0}C) seasonal and annual deviations to the norms of 1961-1990

Year	Winter		Spring		Summer		Autumn		Year	
	T	Δ	T	Δ	T	Δ	T	Δ	T	Δ
1991	-1.5	0.4	12.5	0.8	25.5	1.5	14.7	2.2	12.7	1.1
1992	-2.7	-0.7	10.1	-1.6	23.1	-0.9	12.2	-0.3	10.6	-1.0
1993	-4.7	-2.7	10.1	-1.7	23.2	-0.8	10.6	-1.9	9.7	-1.9
1994	-2.9	-0.9	11.8	0.1	22.9	-1.0	13.4	0.8	11.1	-0.5
1995	-3.3	-1.3	12.4	0.6	23.0	-1.0	12.4	-0.1	11.4	-0.1
1996	-0.5	1.5	12.4	0.6	23.8	-0.1	12.3	-0.2	12.5	0.9
1997	0.3	2.3	10.6	-1.1	23.7	-0.3	11.2	-1.3	11.1	-0.5
1998	-3.3	-1.4	12.5	0.7	24.6	0.6	15.1	2.5	12.6	1.0
1999	2.2	4.1	11.8	0.1	24.1	0.2	12.4	-0.1	12.4	0.8
2000	-0.7	1.2	12.1	0.3	25.2	1.3	12.8	0.2	12.4	0.8
2001	0.4	2.4	12.6	0.9	25.1	1.1	13.0	0.5	12.8	1.2
2002	0.7	2.6	11.2	-0.6	23.8	-0.2	13.5	1.0	11.7	0.1

2003	-3.7	-1.8	10.8	-1.0	23.5	-0.5	13.2	0.7	11.7	0.1
2004	-0.5	1.5	11.7	0.0	24.2	0.3	13.1	0.5	11.8	0.2
2005	-4.0	-2.1	12.1	0.4	24.6	0.6	13.1	0.5	11.8	0.2
2006	-2.3	-0.3	12.9	1.1	26.1	2.1	13.6	1.1	12.1	0.5
2007	-6.4	-4.5	11.4	-0.3	24.0	0.1	14.2	1.6	11.2	-0.4
2008	-5.3	-3.3	14.4	2.6	24.7	0.7	13.9	1.3	11.9	0.3
2009	-1.4	0.5	11.8	0.1	22.8	-1.2	13.4	0.9	12.0	0.4
2010	3.1	5.1	12.6	0.8	26.0	2.1	14.7	2.1	14.0	2.4
2011	0.1	2.0	11.9	0.1	25.1	1.2	11.8	-0.8	11.9	0.3
2012	-2.4	-0.4	12.1	0.4	25.4	1.5	14.9	2.4	12.8	1.2
2013	0.6	2.5	13.5	1.7	24.3	0.4	13.5	1.0	12.3	0.7
2014	-3.9	-1.9	14.2	2.5	25.6	1.6	13.6	1.0	13.2	1.6
2015	2.1	4.1	12.6	0.9	26.2	2.2	14.2	1.6	13.5	1.9
2016	0.5	2.4	13.5	1.7	24.9	1.0	11.9	-0.6	12.4	0.9
1961-1990	**-2.0**		**11.8**		**24.0**		**12.6**		**11.6**	
1998-2016	**-1.5**		**12.1**		**24.4**		**13.2**		**12.1**	

T – is a temperature, and Δ - are deviations from the norm by ^{0}C

Table 9.1 clearly shows that the average temperature in period of 1991-2016, compared to the baseline, increased both annually and seasonally. On average, annual air temperature increased by 0,5^{0}C, and seasonal air temperature increased by 0,5^{0}C in winter, 0,3^{0}C – in spring, 0,4^{0}C – in summer and 0,6^{0}C – in autumn.

8.4.7. Change of river flow up to 2016

To assess the change of river flow in the period of 1991-2016, the long-term Akhuryan river flow observation data of Akhurik and Haykadzor observation points were selected, and the annual values of deviations of those flows were assessed against the average values for the period of 1961-1990 as recommended by IPCC.

Table 8.2. Akhuryan river 1991-2016 factual flow changes compared to the baseline flow

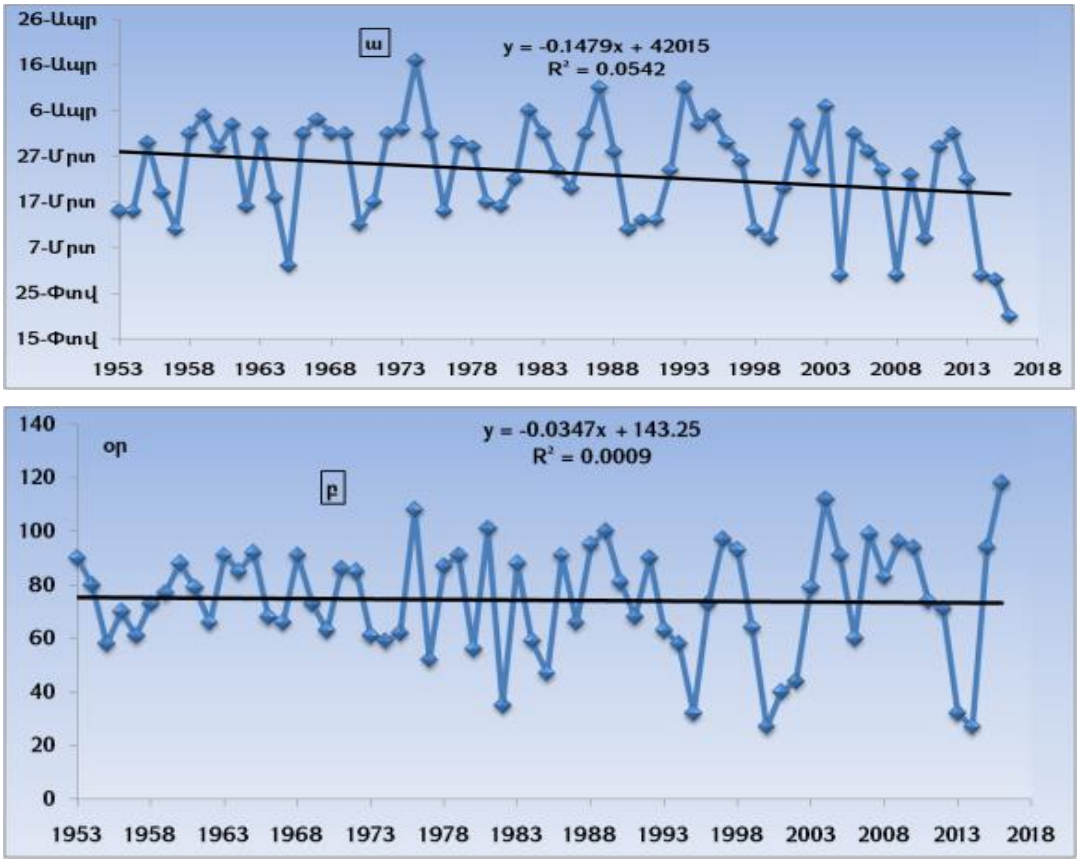
River-observation point	Average river flow, mln. m^3			
	1961-1990	1991-2016	Change	
			mln. m^3	%
Akhuryan-Akhurik	225.7	250.3	24.6	10.9
Akhuryan-Haykadzor	950.1	898.1	-52.0	-5.50

There are differences in flow changes in Akhuryan river basin, at Akhurik observation point the flow increased by 24.6 mln.m^3, and at Haykadzor it decreased by 52.0 mln.m^3, moreover the flow decrease is not that conditioned by hydrometeorological conditions, but by regulation of the Akhuryan river major right-wing tributary - Kars river, by the Republic of Turkey.

8.4.8. Assessment of changes of spring floods and snow cover up to 2016

For the assessment of spring floods changes, two elements were selected – the beginning and duration of floods; as for the assessment of spring floods maximum exits change, they are presented in Extreme hydrological phenomena section of this work.

To study the time changes in spring flood beginning and duration, their long-term change graphic processes were built and equations' trends were defined (See Image 9.1) based on which the assessments were made.



Picture 8.1. Trends in changes of Akhuryan-Akhurik observation point spring floods beginning (a) and duration (b)

The presented curves prove that spring floods beginning and floods duration have decline trend, i.e. the beginning of floods has been shifted to winter by 4-6 days, and the duration of floods decreased by 2-5 days. The reason is the increase of air temperature in the catchment basin.

Mud waters have big role in the formation of river flow. Naturally, the global climate change will have impact on both the river flow amount and the regime. Due to the insufficient data collected on water resource in the snow, particularly in highland areas, which we consider as flow-formation zones, the data on snow cover thickness in meteorological stations during winter were taken for evaluations.

In case of water catchment from Akhuryan river to fill the Mastara reservoir, even in a result of normative water catchment, there will naturally be observed the reduction of flow in the river, and as a result, the ecosystem of the river will be subject to changes, and the large amounts of water catchment may cause considerabal damage to the whole ecosystem.

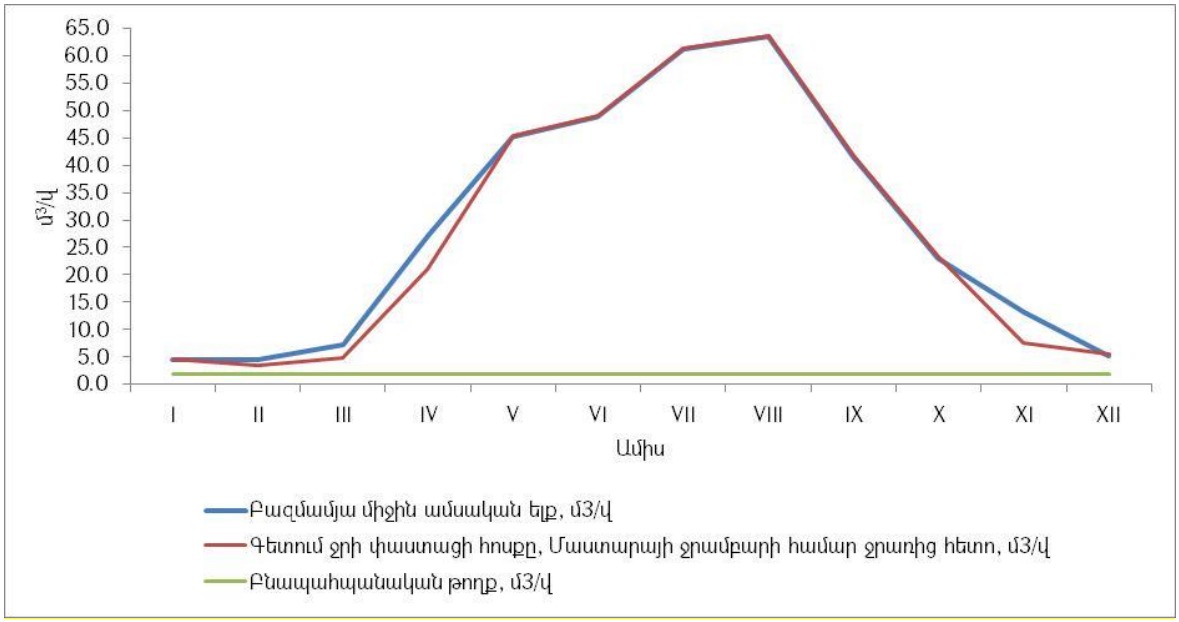
One of the main standards of the assessment of impact on river is the environmental flow (minimal flow that remains in the river after water catchment), which is calculated in accordance with the Annex of the RA Government № 57-N Decree of 25.01.2018.

As per the mentioned methodology, the environmental flow of the Akhuryan river in the water catchment section and at the lower streams (during January, February and December) makes 1.90 m^3/s or 4.92 mln m^3 monthly.

In Image 9.2 are given the river flow at Akhuryan-Haykadzor hydrological observation point before and after the water catchment, as well as the environmental flow.

Table 8.3 – The perennial monthly average flow of Akhuryan-Haykadzor observation point, environmental flow and water catchment from Akhuryan river to fill the Mastara reservoir, m^3/s

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Perennial monthly average flow	4.59	4.88	7.63	27.26	45.28	49.14	61.28	63.62	41.77	23.30	13.38	5.51
Planned water catchment to fill the Mastara reservoir	-	1.49	2.87	6.34	-	-	-	-	-	-	5.74	-
Actual water flow in the river, after water-catchment for the Mastara reservoir	4.59	3.39	4.76	20.92	45.28	49.14	61.28	63.62	41.77	23.30	7.64	5.51
Environmental flow	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90



Picture 9.2 – Annual hydrograph of perennial monthly average flow (m3/sec) of Akhuryan River at Akhuryan-Haykadzor hydrological observation point (blue line); River flow after intake to Mastara reservoir (m3/sec) (red line); and environmental flow (m3/sec) (green line)

As it is shown in hydrograph, on a yearly basis after water catchment the sufficient amount of stream is maintained in the river. Also the hydrograph of the environmental flow has a form of straight line, i.e. the

value of environmental flow for the whole year is constant and in this case it makes 1.90m^3/sec, which has been defined in accordance with the Clause 1, Subclause 4) of the Annex of the RA Government Decree №57-N of January 25, 2018.

At the same time it should be noted, that as per the requirements of the same Decree, the environmental flow should be differentiated by months and seasons. As the water flow is entirely regulated at the observation point and it is almost impossible to bring the water flows to normal at the observation point.

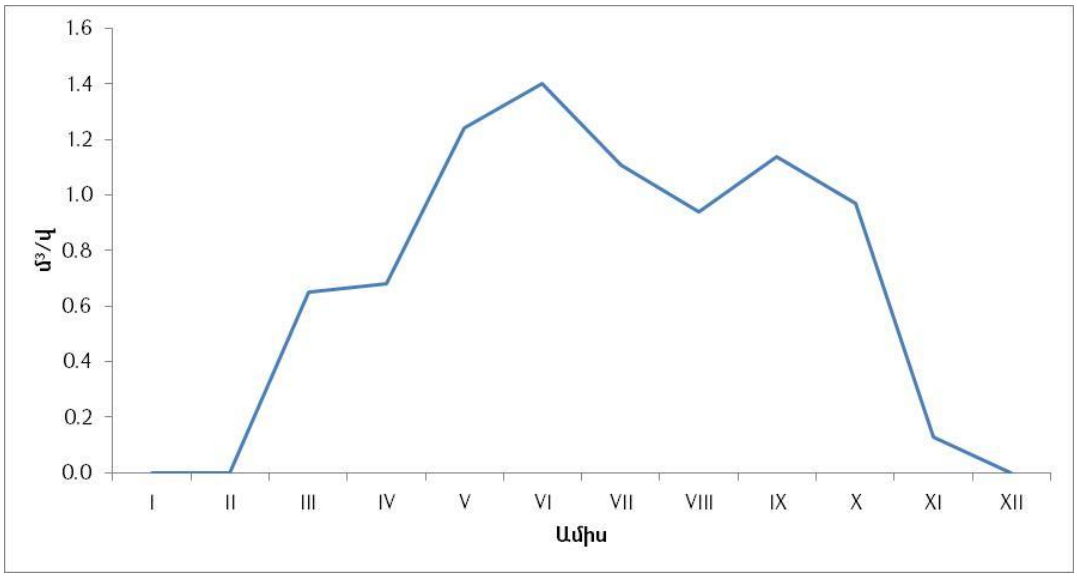
The analysis of the Akhuryan-Haykadzor hydrological point data for the period of 1984-2016 made by us showed that at the environmental flow is maintained at the riverbed of the observation point throughout the year as in January, February and December, the monthly average flow is more than the 4.50m^3/sec flow, and in the other period of the year the riverbed is provided by water resources, conditioned by the water catchment from the reservoir. The average dates of the beginning of the water catchment from the reservoir is the second decade of April, and the end of the water catchment from the reservoir is the second decade of November.

Based on the abovementioned analysis, the water catchment from Akhuryan river to fill the Mastara reservoir, in the environmental terms, may not cause any ecological problem within the Akhuryan river. ***The amount of water left in the river after water intake will follow the natural dynamics of the river with coinciding peak, high-flow and low-flow periods.***

Based on data of perennial monthly average calculated value of environmental flows transported through Selav Mastara river to Mastara reservoir, the Selav-Mastara river average monthly calculated flows annual hydrograph was made.

Table 9.4 – Calculated average monthly flow of the water falling into Mastara reservoir through Selav Mastara river, m^3/s

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Average flow, m^3/s	-	-	0.24	0.26	0.46	0.54	0.41	0.35	0.44	0.37	0.050	-



Picture 9.3 –Annual hydrograph of perennial average monthly volumes of flows transported to the reservoir through Selav-Mastara river

As according to the acting order, the environmental flow is calculated for the rivers with permanent flows, therefore, it was not calculated for Selav-Mastara river.

Mastara reservoir construction will have significant positive impact on the water users below the planned reservoir.

Presently, the irrigation of irrigable lands of the affected areas is implemented through Talin main canal by water resources released from Akhuryan reservoir.

In case of the reservoir construction, there is an opportunity for storage of the additional water resources from Akhuryan river and its use during the irrigation season.

Naturally, compared with the present situation, the accumulated additional water resources provide and opportunity for more efficient organization of irrigation water distribution process in the affected communities.

And in cases, when conditioned by weather-climatic factors water resources below the norm can be observed in rivers, the solutions are offered by the RA Water Code. Article 92 of the Water Code sets, that during the water scarce year, the water resource management body can declare the draught year for the given region or country. Accordingly, as temporary water catchment restriction may be imposed for drought or water scarce years.

One of such examples is the Government Decree 1111-N of September 18, 2014, which temporarily restricts the water use in Ararat, Hrazdan and Akhuryan water basins management areas due to water scarcity and drought conditions.

8.4.9. Long-term effects on wildlife of construction of reservoir

The presence of the reservoir will cause a shift in the terrestrial wildlife species assemblage from riparian to lacustrine with some adverse and some beneficial effects. Specifically, the reservoir will reduce habitats for wildlife species that require flowing water but increase foraging habitat for wildlife that prefer still or slow-moving waters such as waterbirds. Beneficial effects will arise from the new habitats provided by presence of the reservoir.

The reservoir will provide a year round drinking water source for wildlife and have a moderate beneficial impact on all wildlife that use the reservoir as a drinking water source.

Conclusions

The feed source of the planned Mastara reservoir are the following:

- Selav-Mastara river natural flow, which is mainly formed from spring melt, precipitations, as well as mudflows formed in river basin throughout the year;
- Water transported through Talin canal from Akhuryan river;
- The analysis of the existing statistical data shows that the annual flow volumes in Selav-Mastara river make approximately 8.3 mln.m^3.

Analysing the dynamics of 1991-2016 flow in Akhuryan river basin compared with 1961-1990 average, it becomes obvious, that in Akhuryan river basin Akhurik observation point the flow increased by 24.6 mln.m^3, and in Haykadzor decreased by 52.0 mln.m^3, moreover, the decrease in flow is conditioned not that much by hydrometeorological conditions, but by the regulation by the Republic of Turkey of Akhuryan river right-side huge tributary – Kars river.

The beginning and duration of spring floods have downward trend, i.e. the beginning of inundations has been shifted by 4-6 days towards winter, and the duration of floods decreased by 2-5 days. The reason is the increased air temperature in the area of water catchment basin.

In order to assess the vulnerability of river flow due to climate change, the physical-statistical or regression model was selected, which in mountainous conditions of our Republic provides sufficient accuracy of vulnerability assessment.

No connection among meteorological elements was received for Selav-Mastara river, thus the assessment of flow vulnerability by physical-statistical method has not been carried out.

The received results show that, the vulnerability of flow of separate river basins differ from each other, thus in case of similar scenario at Akhuryan river Akhurik observation point section in 2070 and 2100 is envisaged some flow increase – 3-6% (conditioned by precipitations amount), and in Haykadzor section the decrease by 2-10%.

8.4.10. Potential Conflict of Interests between Main Water Users

The irrigation lands in beneficiary area make 4384 ha agricultural lands. There are 6 beneficiary communities in Armavir Marz – Myasnikyan, Hatsik, Lukashin, Noravan, Khanjyan and Norapat, where the number of water user households is 4432.

2 Water User Associations cover the area – Armavir WUA with 3785 water users and Shenik WUA with 647 water users.

The project will essentially contribute to more efficient management of irrigation water as a natural resource, the construction of the reservoir will enable expanding the area old irrigated lands and extending their seasonal use periods, which in turn will contribute to the weakening of land degradation process.

One of the major economic and environmental benefits of the project is its contribution to energy efficiency, as the present electrical pumping stations will not be operated anymore (although they will be kept as irrigation reserves for emergencies).

8.4.11. Shortage of water resources, conflict of interests between main water users and deficit distribution order

Mastara reservoir will permit providing flexibility in use of water resources in various cases of climate change scenarios and thus will be considered as climate adaptation measure. Therefore, the project impact, in general, will be positive.

In a result of the reservoir construction, the existing continental semi-desert natural environment will be transformed into an open reservoir – water area, where the new natural water ecosystem with fishing and other ecological potential will be developed over time.

The reservoir is to be constructed on Mastara-Selav river, which has a temporary (seasonal) flow. Water abstraction from the Selav-Mastara River after entry of the reservoir into operation will allow to follow the natural dynamics of this River.

8.5. Social impacts at operation stage

Economic gains of communities in the coverage area

Discussions with the project beneficiaries showed that vast majority believes their overall living quality will increase, number of labor migrants will decrease, and poverty rate will be mitigated as a result of the project implementation. Mastara reservoir construction will provide sustainable water supply to the beneficiary communities resulting to higher yields and high-value crops production.

Competition for water use

The beneficiary communities, especially those located at the final part of the scheme, have concerns that the reservoir water will be insufficient to cover all their irrigation needs which were raised by the community leaders in their interviews.

Community Impacts (Including Health and Safety)

The presence of dam and reservoir will cause public safety risks in areas adjacent to the reservoir, and below the dam. Because dam owners bear the responsibility of upkeep, they are also primarily responsible when dams fail and cause environmental, economic, and personal damage. It is important to manage risks and avoid or eliminate hazards at dam structures. There is a need for dam owners, operators, and other professionals to be vigilant and proactive in efforts to secure the safety of the area around their properties.

8.6. Summary of impacts

Environmental impacts

Impact on /of	Sensitivity	Expected extent of Impact	Duration of Impact
Environmental and Ecological Impacts during Construction			
Air pollution	Low	Low	Short term during construction
Noise and vibration	Low	Low	Short term during construction
Impacts on water resources during construction of reservoir	Medium	Low	Short term during construction
Water use and drainage	Low	Low	Short term during construction
Extraction of construction materials	Low	Medium	Short term during construction
Generation of construction waste	Medium	Low	Short term during construction
Impacts on biodiversity during construction of diversion pipeline and alternative road	Low	Low	Short term during construction
Impacts on aquatic ecology during construction of reservoir	Low	Medium	Short term during construction
Impacts on terrestrial habitats during construction of reservoir	Low	Medium	Short term during construction
Temporary effects on wildlife during construction of reservoir	Medium	Medium	Short term during construction
Environmental Impacts during Operation and Maintenance Phase			
Impacts on Reservoir Water Quality	Low	Medium	Short term
Sedimentation and Erosion in reservoir	Medium	Low	Long term
Climate change impacts	Medium	positive	Long term
Impact on Akhuryan river water resources	Medium	Medium	Long term
Long term effects on wildlife of construction of reservoir	Low	positive	Long term

Social impacts

Potential Impacts	Sensitivity	Expected extent of Impact	Duration of Impact
Social Impacts during Construction Phase			
Increased traffic	Low	Low	Short term during construction
Blocked access	Medium	Low	Short term during construction
Increased noise and dust	Low	Low	Short term during construction
Increased health problems	Low	Low	Short term during construction
Accidents at construction site	Medium	Low	Short term during construction
Labor influx risks and impacts	Low	Low	Short term during construction
Cultural heritage	Low	Low	Short term during construction
Land use and land acquisition	Low	Medium	Long term
Temporary local employment	High	positive	Short term during construction
Irrigation water supply interruption	High	Low	Short term during construction
Construction camps	Low	Low	Short term during construction
Social Impacts during Operation Phase			
Community safety	Medium	Medium	Long term
Irrigation water sustainable supply - Economic gains of communities	High	positive	Long term
Risk of availability of irrigation water for all beneficiary communities	High	Low	Long term

In summary, the results of the investigation demonstrate that the Project will have mostly low to moderate impacts on the environment if the proposed ESMP is implemented and all proposed mitigation measures are accomplished.

The project, especially during civil works, is expected to cause some short-term negative impacts on air, soil, water, and acoustic environment. Environmental issues likely to be associated with project activities include: noise generation; impact on soil and on water by the construction works; disturbance of traffic during construction works; construction dust and wastes; and worker's safety. However, these adverse impacts will be temporary and site specific and could be easily mitigated through implementing adequate avoidance and/or mitigation measures. Adverse impacts on natural environment and protected areas are not expected.

The water catchment from Akhuryan river will not cause significant impacts if the amount of water left in the river after water intake will follow the natural dynamics of the river with coinciding peak, high-flow and low-flow periods. The reservoir is planned to be constructed on Mastara-Selav river, which is temporary flow, however, the amount of water left in Selav-Mastara river after reservoir will follow the natural dynamics of the river.

When construction is completed and the reservoir begins to fill, the biological communities in the reservoir will begin to acquire lacustrine characteristics. Species that prefer shallow habitat are likely to colonise the periphery of the reservoir, and others that require moving water will disappear or persist as relict populations in the headwaters of the reservoir. Sediment retention and subsequent deposition within the reservoir will cause most of the coarse substrate, rocky outcrops and other elements of the riverbed to progressively disappear under layers of silt transported from upstream. This will alter the fish and macroinvertebrate composition with a reduction in the abundance of riverine fishes and an increase in algal feeders.

The presence of the reservoir will cause a shift in the terrestrial wildlife species assemblage from riparian to lacustrine with some adverse and some beneficial effects. Specifically, the reservoir will reduce habitats for wildlife species that require flowing water but increase foraging habitat for wildlife that prefer still or slow-moving waters such as waterbirds. Beneficial effects will arise from the new habitats provided by presence of the reservoir.

Development of the reservoir will reduce the availability of terrestrial habitat, increasing competition between terrestrial wildlife for limited resources in a smaller land area. The presence of a permanent body of water will increase the value of terrestrial habitat near the shore, thereby partially offsetting the adverse impact of habitat loss. On balance the significance of this effect is judged to be moderate.

Project will have significant positive impact water users, including:

- provision of guaranteed irrigation water at low cost;
- energy savings resulting in limited use of deep wells and reduction of maintenance costs due to gravity irrigation;
- regulating of Selav Mastara River flow and avoiding adverse consequences of floods;
- extension of irrigated land and improved agricultural production.

Consequently, it can be concluded: if all proposed mitigation measures are implemented, the Project can be constructed and operated without having significant adverse impacts on the social and ecological environment in the investigation area and its surroundings.

9. MITIGATION AND IMPROVEMENT MEASURES

The mitigation and improvement measures are envisaged for design, construction and operation phases of Mastara reservoir project. These measures should be undertaken by the implementing agencies to prevent and/or mitigate the above-mentioned possible negative environmental and social impacts.

The requirements for implementation of environmental and social impacts mitigation measures will be included in the final design, technical specifications and tender documents. The measures will be implemented by the construction contractor and the operators of the reservoir and irrigation schemes to avoid from, to prevent, to mitigate or to improve possible impacts.

The affected communities will also be informed of grievance procedures and grievance redress mechanism (GRM) through which the communities can raise their issues, concerns and complaints, keep feedback with the WSPIU and the Contractor about the construction activities and to receive timely responses. The WSPIU and the Contractor will coordinate this procedure.

9.1. Environmental impacts mitigation at construction stage

To prevent and/or minimize the deterioration of landscape, soil erosion, surface and underground water resource and lands pollution at construction stage, the relevant planned measures shall be implemented by the constrictor. Those works include:

- Use of already existing quarries and disposal sites, where possible, according to the requirements set in the appropriate permits and agreements obtained at the design phase; setting definite temporary waste collection zones (which will cause no damage to the vegetation cover and other components of the environment), which shall be maintained by the contractor;
- Reinforce cut slopes with gradient over 5% by concrete layer and gabions to avoid erosion; reinforce large gradients with vegetation, grass and other plants:
- Rehabilitation of damaged vegetation cover and site reinstatement upon completion of works (strip top soil and store is separately during earth work);
- Develop and implement a site construction waste and wastewater management plan to minimise environmental damage from construction activities. This should include the delivery of regularly updated training to construction workers in the safe and proper storage, handling, use, cleanup, and disposal of oils, fuels and other chemicals and the putting in place of a comprehensive spill response plan including equipment and training;
- Install secondary containment measures in areas where fuels, oils, lubricants *etc* are stored and loaded or unloaded, including filling points;
- Install and regularly empty sediment traps in surface drains in around roads and construction areas;
- Minimise soil disturbance and excavation during wet season;
- Install culverts where roads cross streams;
- Provide entrance and exit principles for the traffic and construction sites, defining the precise routes, parking areas and work implementation schedule.

Measures to minimize dust and noise at construction site, particularly in case when the works are implemented in the vicinity of residential and public areas. For the purpose, to haul the construction materials and waste it is necessary to use trucks with covers. Earthwork shall be executed with techniques and equipment with dust trap. The transportation means and equipment shall be periodically checked, regulated and equipped with muffles. The construction sites and the access roads shall be periodically watered, the crushed stone, the soil mass stored and hauled shall be dampened to minimize the dust (besides winter months and precipitation seasons). Liquid construction materials shall be stored in covered and protected places.

To predict and adequately respond to the impact on air basin, the surveys of patterns and peculiarities of spatial and time distribution of atmosphere diffusion, as well as the distributions of air emissions are of particular importance. The results serve as a basis for the objective assessment of the state of atmosphere pollution and for the potential measures aimed at providing atmosphere cleanliness.

In general, the pollution of the atmosphere is conditioned by the exhaust mixture quantity, climate conditions, particularly by the temperature field, intensity of diffusion, wind speed, etc. In turn, the state of atmosphere in mountainous countries depends on the surface roughness.

After construction of the reservoir, as per the long-term forecast of meteorological factors in context of climate change, on the basis of Hydro meteorological Service researches, the temperature in the area of the reservoir and its adjacent area will increase by about $3^{O}C$ by 2050, the winds will decrease by about 0.2 m/s, the precipitations will decrease by about 3% and the evaporation will increase by 7-8 %.

These changes will have **positive impact** on the environment, as will to some extent mitigate the climate change in the area.

Construction camps

Each construction camp should be created after the consultation with the environmental specialists of the supervision consultant. Construction camps should be arranged in parallel with the track in the areas with no vegetation. Temporary structures must also be located in the water pipe maintenance zones, above the ground surface, and in the areas with no vegetation. The construction camps must be in good technical condition and provided with water supply and drainage solutions, as well as bins. Construction camps must be located on free community lands agreed with the community, avoiding use of private lands.

Protection of plant species and soil-vegetation layer

It is necessary to provide a possibly narrowest pipeline route corridor for all types of construction operation. Prior to commencement of the construction, the existing bushes in the areas of planned works shall be removed. It should be provided, that the removal of the plants is implemented along the pipeline route only to prevent the impacts beyond the designated corridor. Given that during non-vegetation period, if damaged, the roots of the trees are recovered much easier than during vegetation period, the excavation of the trenches will be carried out before or after the vegetation period of the trees in the pipeline corridor area. This will mitigate or exclude the possible negative impact of the planned works on the natural topsoil and tree-bush vegetation. To minimize the damage to the vegetation at the areas of water pipe installation, according to the RA Government approved order, the fertile soil layer shall be cut and stored at a designated area for further reinstatement of the areas. After the backfill and leveling of the trenches, the vegetation-covered areas soil-vegetation layer will be restored to its previous place.

Waste management

The purpose of the waste management is to set for the contractor and staff the correct principles for removal, location and usage of waste originated during construction.

Safe wastes include construction and solid domestic wastes, vegetable residues, which can occur in canals or at construction sites in form of bushes and hinder implementation of construction works. The improper storage of these wastes, their transportation and removal can cause negative impacts for the nearby areas.

Hazardous wastes can be inflammable, degradable, radiation or toxic and may have severe impacts. The hazardous wastes originated during construction can include batteries, paints, solvents, used oils, lubricants and other chemical wastes.

Wastewater include construction water flows (which can originate at construction sites) and domestic wastewater (which can originate in a result of economic activity of employees) and may contain contaminants and pathogenic elements.

To avoid the harmful impacts of the abovementioned wastes, the following management principles are preferable:

- Minimize generation of waste;
- Recycle or process wastes, to the extent possible;
- Remove the accumulated waste according to the RA legislation, agreed with the Community Mayor, or with relevant authorities;
- Use the existing mines and waste disposal sites (according to the provisions stated in the acquired agreements in the design phase);
- Obtain the construction materials (inert materials, concrete) from the certified suppliers or to use the existing mines;
- To define the right temporary accumulation area for waste (most acceptable from the viewpoint of environment protection which will be approved by relevant authorities).

During construction works, to exclude the leakages of oil and fuel to the surrounding areas and water horizons, while storing or refilling the oil or fuel, a temporary filling point for the fuel shall be organized in the construction camp, which will be equipped with accumulation system of the leakages. After the works, it shall be dismantled. In case of leakages it is required maintain cleaning operations and to inform to the Ministry of Nature Protection.

By applying the abovementioned principles and the relevant training courses related to the waste management the risks will be minimized during the construction process.

Use of excess humus for planting, and the use of excess soil mass for the rehabilitation of roads, should be implemented with the agreement of affected Community Mayors.

Construction materials

If the Contractor would prefer or would have to use its own quarries for construction, he shall strictly follow the requirements set by the legislation and develop mitigation measures for specific case or for development of specific type of quarry. In particular, all the general requirements set forth to the mining industry sector for all the elements of the environment (atmosphere air, soil, water, flora and fauna) as well as the WB Group Industry sector EHS Guidelines for Mining shall be fulfilled. These Guidelines are applicable to underground and open-pit mining, alluvial mining, solution mining, and marine dredging. Extraction of raw materials for construction products are addressed in the EHS Guidelines for Construction Materials Extraction and all the measures for mitigating the possible environmental and social impacts shall be executed. The Contractor shall pay special attention to mitigation of the possible dust emission, expected high noise caused by blasting and operation of heavy equipment during development of the quarry, the expected impacts on the fertile soil layer, the expected impacts of the wastewater removal, possible spillage of fuel, mitigation measures aimed at health and safety of labor involved on the quarry development. Upon completion of the quarry the Contractor shall implement quarry closing program and land restoration according to the stipulated procedures. These procedures are specified by the legal documents regulating the mining industry in RoA.

The participants and distribution of their roles in this process are presented in Appendix A.

9.2. Social impacts mitigation at construction stage

Construction-related temporary impacts

Construction contractor should properly inform the affected communities on the date of commencing construction works, which may result in temporary closing of roads or emerging of obstacles on the roads, as well as increased noise level. To mitigate such impacts, the contractor will implement the following measures:

(a) Increased traffic

The Contractor will offer an alternative road bypassing the construction site.

(b) Blocked access

The Contractor will locate construction camps and machinery far from residual areas, public facilities, private assets and/or lands to avoid blocking access.

(c) Noise and dust

To mitigate the impact of dust and noise from construction activities and equipment operation it is required to:

- Install construction camps as far as possible from the inhabited areas;
- Carry out noisy works during day hours;
- Reduce the usage of heavy technique near the inhabited areas as possible;
- Install noise absorber plants on machine equipment.
- Use dust management technologies during activities in the inhabited areas.

(d) Health problems

To avoid allergic, respiratory and other health problems the construction materials use by the contractor should meet international standards.

(e) In order to avoid or minimize safety risks associated with the construction works, the following mitigation measures are proposed:

- Raise awareness of negative impacts during construction works;
- Ensure that workers and any visitors are provided and use personal protective gear;
- Insure that workers receive worksite safety training;
- Insure that workers operating large equipment are properly trained and licensed;
- Ensure that construction equipment is inspected and licensed;
- Ensure that construction equipment is used strictly following its operation instructions;
- Keep first aid medical kits and fire-fighting equipment on site;
- Prohibit on-site activities beyond the working hours.

Ensure that active work sites are fenced to prohibit its access by children/people and avoid getting injured.

Temporary land use

Preliminary agreements from communities for implementation of project activities in the communities during construction are included in Annex 5. Should any use of private lands be required at any stage of the construction or operation of the system, the construction contractor must immediately stop all works, inform the PIU, and prepare a RAP, if required, in compliance with the Resettlement Policy Framework.

Temporary local employment

Women traditionally do not work in construction in Armenia. However, employment for women should be encouraged by the contractor offering jobs that can be acceptable for women and giving previlige to female candidates.

Disruption of irrigation water supply

The construction activities, which might hinder irrigation water supply to the affected communities through existing irrigation systems, should be postponed to non-irrigation season.

Construction camps

The construction contractor will obtain the community agreements to install construction camps on unused community lands or will sign a lease contract with the community for land use.

9.3. Environmental impacts mitigation at operation stage

The main environmental risk at operation stage is providing the rational use of water resources. At operation stage, the reservoir water balance maintenance and water flows management plan will be developed with its implementation supervised by both state administration authorities and local governments. Following mitigation measures are proposed:

- Undertake regular (preferably continuous) flow monitoring downstream;
- Undertake regular water quality monitoring in reservoir tracking dissolved oxygen, nutrients (N & P), pesticides and nuisance plants.

9.4. Social Impacts Mitigation at Operation Stage

Competition for water use

Equitable distribution of reservoir water between the beneficiary communities as well as between water users in each community inside the communities as per water requirements of the cultivated crops should be managed by the WUAs responsible for irrigation water supply of those communities - Armavir WUA (Khanjyan, Lukashin, Hatsik, Norapat, Noravan communities) and Shenik WUA (Myasnikyan community).

Community safety measures

Because of the risks and legal liabilities involved with dam management, it is of absolute importance that owners and operators appropriately address risk and potential hazards at and around their dams. Following measures are proposed:

- Conduct risk assessment to identify conceivable failures, as well as their probabilities and consequences, in accordance with internationally accepted practices. Through this disciplined approach, identify the elements of the physical infrastructure and the operating procedures that need to be routinely inspected, monitored, and adjusted to achieve the acceptable levels of risk associated within the dam safety program;
- Continuous education campaigns to sensitize community residents about the risks of drowning in the reservoir, tailrace or downstream river system. These activities involve information and periodic awareness campaigns to potentially affected communities, especially delivered at schools, community centers, and the like;
- Prepare and follow a dam safety and emergency response management plan that defines the operating procedures and specifications to protect the physical health and safety of people (residents, workers, and visitors) and their socioeconomic regime, the physical environment and its ecological habitats, and the integrity of the dam and associated project components to ensure sustainable, safe optimal performance;
- Conduct studies to map signs of existing instability, prior to reservoir filling;
- Determine slope movement rates, slope strength, mechanical properties, and groundwater pressures, and conduct slope failure modeling;
- Establish reservoir operation and water level management height (filling and drawdown limits and rates) to foster long-term stability per slope failure model predictions (for example, larger freeboard when climatic conditions favor flooding);
- Warning signs along the shore of the reservoir;

- Warning signs and alarm or community warning systems in downstream areas subject to sudden water level fluctuations.

9.5. Mitigation of impacts on cultural heritage

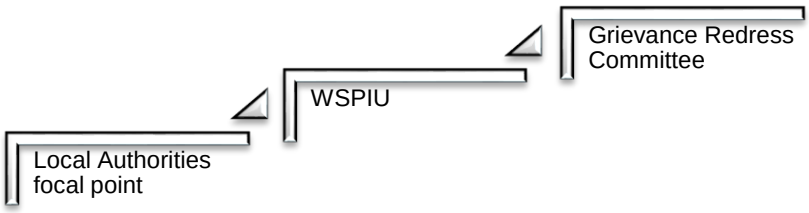
If during construction works historical-cultural monuments or other cultural materials are discovered, the Contractor will immediately interrupt the works and present a corresponding report to the State agency for protecting historical-cultural monuments. The specialists of the agency will carefully study the discovered material and give their professional opinion, based on which either the works will continue, or the design will be reviewed.

10. GRIEVANCE REDRESS MECHANISM

10.1. General information

The grievance redress mechanism (GRM) is a system through which people will be able to communicate their questions and concerns regarding the project and be assured of a timely response. The WSPIU has established a Grievance Redress committee (GRC) to address affected people's concerns and complaints proactively and promptly, using an understandable, communicated, and transparent process that is gender responsive, culturally appropriate, and accessible to all segments of the affected people and beneficiary community at no cost The GRC consist of the environmental and social specialists, an engineer and the lawyer of the PIU. The GRC will collaborate with local authorities and will involve them in the Grievance Redress Mechanism. Local authorities will provide information to their communities how to express their grievances through various channels (in person to local focal points, over phone, email or online) and will support them if needed. The complaints and grievance from the stakeholders, affected communities and NGOs will be submitted to WSPIU GRC. The mechanism will not impede access to the Country's judicial or administrative remedies. Prior to Construction works, WSPIU will inform the beneficiary community about the grievance redress mechanism and provide contact details of persons responsible for grievance collection and response in the community. The PIU will also explain the importance of selecting some volunteers (perhaps water users) who can be project focal points for the community to assist persons from their village with resolving or escalating grievances as needed.

Grievance Redress Mechanism



10.2. Grievance redress committee, tasks and composition

The GRC includes WSPIU staff: the environmental specialist (head of committee), the social specialist, the engineer, coordinating gravity irrigation schemes designs, and the lawyer.

The head of the GRC will coordinate the works of the committee and as an environmental specialist he/she will also respond to complaints and/or concerns related to environmental flow, protection of biodiversity, climate change and other environmental issues.

The social specialist will respond to complaints of social nature or those related to private land or community land use.

The communication specialist will be responsible for provision of information and clarifications to media inquiries.

The engineers will be responsible for addressing grievance related to technical solutions and design of the project.

And the lawyer will support the team in redressing more complicated complaints when knowledge or study of the relevant law and regulation is needed.

The information on creation of GRC with possibility for online submission of grievance and complaints is posted in the WSPIU website.

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures. The grievance mechanism will be implemented so that people can get their problems solved and grievances redressed in a timely and effective manner without directly addressing the court. All grievances will be responded to within a week of receipt and resolved within maximum one month of receipt.

The information on the GRM as well as the hotline will be communicated to the communities and households who will be affected by the gravity scheme, local authorities and NGOs during public consultation and posters about the construction works posted at the construction sites and the Municipalities so that the affected persons can submit their feedback and complaints during construction and operation phases.

WSPIU will maintain a detailed log of all questions or grievances received, including the date of submission, contact information of the person submitting, nature of feedback or complaints, date of response, date of resolution, and any follow-up actions if needed.

Should the inhabitants of the beneficiary or impacted communities of the Project, other stakeholders, NGOs or other organizations have any complaints, proposals, or need any clarification, they may apply and communicate with GR commission which was established and operates under the PIU. The information about the Commission is presented in the PIU's web site piu.am. The contacts of the Commission members are presented below:

Martiros Nalbandyan, WS PIU Environmental Specialist 041 111450,

Marine Vardanyan, WS PIU Social Specialist 041 111437,

Margarit Sargsyan, WS PIU Communication Specialist 041 111435,

In case of any complaints, proposals, or need any clarification, the inhabitants of the beneficiary or impacted communities of the Project or other stakeholders may write to following e-mail address as well: ***info@wsdp.am.***

11. INSTITUTIONAL RESPONSIBILITIES

11.1. Agencies

11.1.1. Implementing Agencies

The implementing agencies are responsible for the implementation of mitigation measures included in the ESIA and ESMP. The design phase implementer - the design consultant should ensure that before announcing tender for construction works all the required permissions and agreements are acquired from the relevant authorized state and local authorities (e.g. on use of water resources and systems, the areas of excavated soil, wastes and construction waste removal).

The construction phase executing agencies (construction contractors) will be responsible for executing monitoring measures provided in the EMP as well as for requiring all the permissions and agreements concerning the construction works (e.g. obtain agreement with state agency of history and protection of cultural monuments, in case if historical/cultural/ancient monuments or other cultural materials unexpectedly occur during construction works).

All these will be carried out according to the requirements of acting environmental and social legislation of Armenia. Besides, the construction contractors should fulfill the special technical conditions included in their contracts, which are presented in the Annex of the given document.

11.1.2. Supervising Agencies

Acting in the capacity of the Project implementing entity, SCWE will have an overall responsibility for the Project oversight, and will provide supervision of its implementation through the PIU. The PIU will hire a supervising company licensed to carry out technical supervision of construction, which will include oversight on the environmental and social compliance of works. According to the RA legislation, it is exclusively a licensed company that may carry out the technical supervision of construction. Such company shall have an adequate skill mix of staff so that environmental and social monitoring is undertaken at the same level of professionalism and diligence as other technical aspects of works. Additional oversight will be provided by the local community of the project stakeholders and NGOs.

The role of the PIU will be quality control of the supervision company's work and will imply periodic site visits of the PIU's in-house staff to verify the information provided by the supervisor. PIU shall review and provide feedback on the supervision company's reports, as well as take timely and effective actions addressing the issues raised in the supervisor's reports. PIU will also track procedures of obtaining all necessary permits, licenses, and agreements by the works contractor and will follow compliance of works with the terms and conditions that these permits, licenses, and agreements.

According to RA legislation, environmental supervision on the entire territory of the Republic is carried out by the State Environmental Inspectorate under the Ministry of Nature Protection of RA, which also has a corresponding territorial department in the region of Armavir and Aragatsotn. The specialists will implement environmental supervision in the project implementation area both during the construction and future operation stages.

11.1.3. State Agencies

State agencies, authorized to apply the state laws, norms and standards related to the works envisaged for Mastara reservoir, are as follows:

- State Environmental Inspectorate of the RA Ministry of Nature Protection tracks water intake from natural water bodies and river pollution, and;

- Sanitary service provided by RA Ministry of Health inspects sanitary conditions at the construction sites.

11.1.4. Monitoring Agencies

The agencies conducting monitoring are responsible for the efficiency of mitigation and improvement measures monitoring and for the further project compliance, if necessary. Monitoring agencies are responsible for the implementation of all the required measures. State agencies may also carry out monitoring within their authority.

11.2. Reporting Responsibilities and Schedule

Author of the system design and the construction supervision consultant report to PIU on the progress of construction works. Environmental and social monitoring of works is included in the assignment of the supervision consultant. The consultant reports to PIU on the project progress on monthly basis. Monthly progress reports include, inter alia, a chapter on the environmental and social performance of works contractor. Textual part of the report describes general status of safeguards compliance, fleshes out main issues, and describes actions taken for addressing these issues. Completed field environmental monitoring checklists (template attached to this ESIA report) are to be attached to the monthly progress reports too. The consultant's obligations also include reporting to PIU on any accidents during construction (accident report form also attached hereby in Appendix C) immediately upon occurrence of such accident.

The WSPIU will submit the World Bank semi-annual project progress reports that include, inter alia, a chapter on the safeguard compliance. This chapter provides assessment of the contractor's environmental and social performance as well as assessment of the supervision consultant's environmental monitoring work. PIU's environmental and social reports will be based on the inputs from the supervision consultant, but will also carry information on the PIU's own field work aimed at verification of information incoming from the supervision consultant and at addressing any outstanding issues flagged by the consultant.

11.3. Budget

ESMP attached to the present ESIA report, the estimated LAR compensation amount will be included into the bidding documents once the civil works are tendered, so that bidders are able to include costs of the required mitigation measures into their bills of quantities.

12. PUBLIC PARTICIPATION

In the design stage, the ESIA consultant carried out surveys and consultations in the project affected areas to obtain basic baseline data. The objective of these consultations was to assess the existing social issues, as well as the expected social impacts, providing information on Mastara reservoir project to the representatives of the project affected communities find out their concerns and opinions in order to consider them when finalizing the ESIA report and design documents. As per Mastara reservoir design, during preparation of the ESIA report, 3 public consultations have been conducted with participation of Dalarik and Lernagog Community Mayors, WUAs and communities' population. The public consultations schedule is presented in Table 13.1.

Table 13.1. Public consultations schedule

N	Community	Venue	Date	Time	Number of participants	of whom women
1	Dalarik	Community Administration	22.12.2017	11:00	17	6
			06.02.2018	11:00	18	4
			30.03.2018	11:00	15	4
2	Lernagog	Community Administration	26.12.2014	13:00	18	7
			06.02.2018	13:00	14	4
			30.03.2018	13:00	14	3

Conducting preliminary surveys in the MRP design area, the ESIA consultant, according to the RA Law on Environmental Impact Assessment and Expertise, on December 22, 2017 organized first public consultations in the RA Armavir Marz affected communities – Dalarik and Lernagog which administrative area the reservoir is to be constructed on. During public consultations, the affected communities were presented the preliminary design of the reservoir.

Then, the consultant submitted the application for ESIA expertise to the Ministry of Nature Protection Center of Expertise for Environmental Impact Assessment SNCO, in accordance with the RA Law on Environmental Impact Assessment and Expertise. On February 6, 2018 the SNCO organized the second public consultations and later on March 30, 2018 the Consultant organized the third public consultations in the affected Dalarik and Lernagog communities (Minutes of public consultations are presented in Annex 7).

The population of the two affected communities was informed about public consultations 7 days prior to the scheduled meeting. The announcement on holding public consultation was published in the "Hayastani Hanrapetutyun" ("Republic of Armenia") daily newspaper and was posted on the announcement boards of the affected village administrations. The affected Community Mayors, members of community administrations, farmers, water users, specialists in charge of implementation of the project, representatives of consultant team and specialists of the WSPIU were among the participants of the public consultation.

During consultations, the participants were informed about the project objectives and issues. The participants were provided information on the design solutions proposed for the project implementation, as well as on project implementation phases. During consultation meeting, the participants were provided information on the general description of assignments, details of the proposed construction works, potential negative impacts and envisaged mitigation measures under the Mastara reservoir project, as well as the importance of the project works for the local population, expected results, etc.

Answers were given and clarifications provided to all the questions raised by the participants.

The questions, suggestions, opinions and considerations raised during consultations were recorded in order to consider them in future, if possible.

In general all participants approved this component of the Mastara reservoir project. The details are provided in the Minutes of public consultation meetings, presented in the Annex 7.

Upon clearance by the WB this ESIA report will be disclosed through the WSPIU website. Public consultations will be organized to discuss the details of environmental and social impacts and to listen to the opinions of communities and NGOs representatives in order to include them in the report.

After the clearance of this ESIA report by the World Bank, the next public consultations will be organized to disclose the ESIA report. Public consultation meetings will be held in accordance with the World Bank procedures and policies, as well as with the RA legislation, taking into consideration the schedule of publication, organization of public consultations, discussions and receiving of comments. The updated ESIA report with the Minutes and photos of public consultations will be submitted to the World Bank and Eurasian Development Bank for the final clearance. Upon receiving of the final clearance, the ESIA report (in Armenian, Russian and English languages) will be posted on the WSPIU website.

13.Environmental and Social Provisions of Civil Works Contracts

The majority of impacts expected to occur during the construction will be mitigated by adhering to appropriate provisions in the contracts of construction works. These provisions are presented in Annexes.

ESMP will be included in the official documents of civil works and constitute an integral part of work contracts. The requirement of conducting monitoring of environmental and social performance of work contractor will be a part of the ToR of the technical supervision company hired by PIU.

In case of damage to the environment due to failure to observe requirements of ESMP and the national legislation of the RA (in particular, damage to the topsoil, covering the area with rubbish and construction waste etc.), penalties will be applied according to the Criminal Code and Administrative Violations Code of the Republic of Armenia and Republic of Armenia law “On Compensation payments for damages to flora and fauna due to environmental offences".

Thus, the Articles 281-298 of Section 10 (“Crimes against the environmental security”) of the Criminal Code of the Republic of Armenia refer to the preservation of water and soil, atmospheric air, fish stocks, and other natural resources, and set sanctions for damage caused to the environment. Articles 42-95 of the Code on Administrative Violations cover violations of the sanitary-hygienic rules, state ownership rights to the mineral resources, water, forests, flora and fauna, as well as violations related to the topsoil use order and water resources conservation rules. Finally, the Law on “Tariffs for the damage caused to fauna and flora as a consequence of environmental violations” determines specific rates of compensation. Particularly Articles 6, 7, 8 of Chapter 3 of the Law define the calculation of the amount of compensation, as well as procedures for collection of compensation.

Size of penalties, fines and compensations due to the above-mentioned regulations are periodically revised and increased, and thus provide sufficient obstacles for the violations of the requirements of the ESMPs by the companies.

All mentioned laws and regulations will be fully applied to the physical works undertaken by Contractors for construction of Mastara reservoir project. As the present ESIA and ESMP have undergone an expert environmental examination and submitted to the local State Environmental Inspection Bodies, which are in charge for supervision of the above-mentioned measures.

If any violation is revealed, they form an appropriate administrative violation act, indicating the violated law item and the corresponding penalty.

Annexes

Annex 1. Environmental and social management plan: mitigation measures

Annex 2. Monitoring plan

Annex 3. Accident reporting form

Annex 4. Field environmental management monthly questionnaire

Annex 5. Agreements of affected communities

Annex 6. List of used literature

Annex 7. Record of public consultations

Annex 1. Environmental and Social Management Plan. Mitigation Measures

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Planning / Design phase					
Risk of non-compliance with national and international standards and requirements	- All necessary permits for Project construction and operation are identified and obtained; - All issues, associated with land use/property are settled down/coordinated and/or negotiated; - Completion of the analysis of Project design and specifications and its cumulative impacts on environmental and socio-economic conditions. The analysis is to ensure the Project is in line with best international practices and allows incorporation of appropriate measures to minimize / reduce / avoid adverse environmental and socio-economic effects of the project implementation with enhancement of beneficial impacts.	WSPIU Contractor	Before starting construction works	Inspectorate for Nature Protection and Mineral Resources WSPIU	Included in project costs
Floral and Faunal Diversity Protection	- Pre-construction Expert inspection of reservoir, dam, water pipeline and alternative road route to identify local flora, fauna and faunal habitat and clarify protection priorities; - Mark sites supporting protected flora and fauna; - Site inspections in company of Contractor's design engineers and flora and fauna experts;	Contractor	During design works	WSPIU	Included in general cost-estimate

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
	- Specification of reservoir, dam, water pipeline and alternative road, including course changes to avoid protected flora and fauna impacts; - Review of support facilities and specification of their locations to avoid damaging protected flora and fauna; - Expert consultations with clients and MNP to determine appropriate offset of compensation measures if impacts are unavoidable.				
Construction stage					
Historical and cultural values, areas	Carry out the area survey and contact the Ministry of Culture if areas with cultural heritage are detected. During final design, an archeologist should conduct a visual inspection of the site and prepare a report based on the screening conducted. The same archeologist should develop the chance find procedures that should be used in the event that any archeological objects are found during construction. Contractor/Supervision consultant should receive a short training on the handling of archeological objects in line with the procedures.	Contractor	During construction works	WSPIU Through supervising consultant	Included in general cost-estimate

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Construction stage – earthworks - soil cover damaging, erosion phenomena - water resource pollution	• Minimize the area used for construction camps in order to reduce the damage to the external soil layer; • Carry out anti-erosion measures along the access roads; • Avoid works on slopes; • Minimize use of vehicles and equipment outside the road; • Implement drainage control measures (drainage pipes, dams, etc.); • Carry out watering in the volumes not allowing the formation of flows; • In all construction camps use the existing domestic capacity; • Provide all the warehouses with bypassing canals and dams; • Avoid washing of vehicles at work sites; • Install secondary containment measures in areas where fuels, oils, lubricants etc are stored and loaded or unloaded, including filling points.				

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Waste generation Air basin pollution	• Waste management system introduction; • Developed waste management plans considering the following principles: (i) waste management hierarchy in order to avoid-minimize-reuse-recycle-remove wastes; (ii) waste sorting, (iii) reducing construction wastes in a result of proper technical planning; (iv) staff training; • Storing of all hazardous wastes (e.g. oil, fuel, paint, soil, polluting oil) in the adequate storing area; • Scrap metal (iron, steel, copper, etc.) originated in a result of construction works shall be reused or sold to the licensed companies for recycling; • Lubricants residues originated in a result of construction works shall be collected in special containers and sold to the licensed companies; • Carry out watering during earthworks; • Covering trucks during materials transportations; • Store bulk materials under the cover; • Exclude waste burning.				

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Construction-related temporary impacts 1. Increased traffic 2. Restriction of access 3. Noise and dust Health problems	1. Community will be offered construction site bypass road 2. Construction camps, construction machinery will be located far from residual areas, public facilities, private assets and/or lands to avoid blocking access. 3. To mitigate the impact of dust and noise from construction activities and equipment operation it is required to: • Install construction camps as far as possible from the inhabited areas; • Carry out noisy works during day hours; • Reduce the usage of heavy technique near the inhabited areas as possible; • Install noise absorber plants on machine equipment. • Use dust management technologies during activities in the inhabited areas. • Monitor dust emissions and noise levels in settlements adjacent to construction activities. To avoid allergic, respiratory and other health problems the construction materials used by the contractor shall meet the international standards.	Contractor	During construction works	WSPIU Through supervising consultant	Included in general cost-estimate

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
4. Traumatism and accidents at work site;	Develop and implement Health and Safety Plan Raise awareness of negative impacts during construction works; Ensure that workers and any visitors are provided and use personal protective gear; Insure that workers receive worksite safety training; Insure that workers operating large equipment are properly trained and licensed; Ensure that construction equipment is inspected and licensed; Ensure that construction equipment is used strictly following its operation instructions; Keep first aid medical kits and fire-fighting equipment on site; Prohibit on-site activities beyond the working hours; Ensure that active work sites are fenced so that children/people cannot access and become injured.				
Borrowing for construction material - Slopes erosion and landscape damage - River banks erosion, pollution of water flow with weighted particles, and disturbance of aquatic life	• Purchase of inert materials from the existing suppliers; • Obtaining of the license for production of inert materials and strict compliance with the license; • Terrace working on quarries, backfill on the worked areas and harmonization with the landscape;	Construction contractor	Before starting construction works	WSPIU Inspectorate for Nature Protection and Mineral Resources	Included in construction costs

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
	• Working out of gravel outside water flow, arrangement with separating ridges and without putting equipment into water flow.				
Temporary and/or permanent use of community lands	Community land use during construction stage will be based on previously acquired Agreements from respective communities. Should any use of private lands be required at any stage of the construction or operation of the system, the construction contractor must immediately stop all works, inform the PIU, and prepare a Resettlement Action Plan (RAP), if required, in compliance with the Resettlement Policy Framework. All the cases of accidental damage to private assets or community property will be compensated and reinstated to its previous state to the extent possible.	WSPIU Technical supervision consultant Construction contractor Author's supervision consultant	During construction works	WSPIU Technical supervision consultant	Included in total expenses
Lack of temporal employment opportunities for local women	Employment for women should be encouraged by the contractor offering jobs that can be acceptable for women and giving previlige to female candidates.	Construction contractor	During construction works	WSPIU Technical supervision consultant	Included in total expenses
Irrigation water supply interruption	The construction activities, which might hinder irrigation water supply to the affected communities through existing irrigation schemes, should be postponed to non-irrigation season.	Construction contractor	During irrigation season	WSPIU Technical supervision consultant Local authorities	Usual expenses related to construction works
Land use for construction camps	The construction contractor will obtain the community agreements to install construction camps on unused community lands or will sign a lease contract with the community for land use.	Construction contractor	Before construction works start	WSPIU	Usual expenses related to construction works

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
				Technical supervision consultant Local authorities	
Community Health and Safety	Prepare and follow a dam safety and emergency response management plan that defines the operating procedures and specifications to protect the physical health and safety of people (residents, workers, and visitors) and their socioeconomic regime, the physical environment and its ecological habitats, and the integrity of the dam and associated project components to ensure sustainable, safe optimal performance; Conduct studies to map signs of existing instability, prior to reservoir filling; Determine slope movement rates, slope strength, mechanical properties, and groundwater pressures, and conduct slope failure modeling; Establish reservoir operation and water level management height (filling and drawdown limits and rates) to foster long-term stability per slope failure model predictions (for example, larger freeboard when climatic conditions favor flooding); Warning signs along the shore of the reservoir; Warning signs and alarm or community warning systems in downstream areas subject to sudden water level fluctuations; Access control (fencing) to prevent access into high risk areas.	Dam owner	Before commissioning work	Ministry of Emergency Situations	Included in project costs

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Operation stage					
Competition for water use between beneficiary communities	Equitable distribution of reservoir water between the beneficiary communities as well as between water users in each community as per water requirements of the cultivated crops should be managed by the WUAs responsible for irrigation water supply of those communities - Armavir WUA (Khanjyan, Lukashin, Hatsik, Norapat, Noravan communities) and Shenik WUA (Myasnikyan community).	Water Intake Company-WUA	During system operation	State Committee for Water Economy (SCWE)	State budget
Construction of reservoir will displace animals from reservoir area into surrounding habitat, causing crowding. The dam and reservoir will fragment aquatic and terrestrial habitats, resulting in reduced habitat quality. Habitat conditions will change from riverine to lacustrine, causing a reduction in riverine species.	Habitat restoration and management to support displaced fauna. Develop and implement long-term wildlife and vegetation monitoring and management programme to document changes in aquatic flora and fauna in the reservoir and address any problems that may occur.	Operating organization	Throughout operation of the system	MNP	Included in operational costs
Sedmimentation within the reservoir may affect dam operation.	Monitor sedimentation within the reservoir.	Operating organization	Ongoing	Ministry of Emergency Situations	Included in operational costs

Potential negative impacts	MITIGATION MEASURES	Responsible agencies	Mitigation measures timing	Supervising agency	Mitigation measures costs
Water quality impacts	Manage water quality (including aspects such as water temperature, dissolved oxygen, total dissolved gases, contaminants, salinity, nutrients and minerals, and turbidity) on a project-specific basis according to the water quality objectives of the reservoir and the river system.	Operating organization	Throughout operation of the system	MNP	Included in operational costs
Community Health and Safety	Conduct risk assessment to identify conceivable failures, as well as their probabilities and consequences, in accordance with internationally accepted practices. Through this disciplined approach, identify the elements of the physical infrastructure and the operating procedures that need to be routinely inspected, monitored, and adjusted to achieve the acceptable levels of risk associated within the dam safety program; Continuous education campaigns to sensitize community residents about the risks of drowning in the reservoir, tailrace or downstream river system. These activities involve information and periodic awareness campaigns to potentially affected communities, especially delivered at schools, community centers, and the like.	Operating organization	Periodically during operation	Ministry of Emergency Situations	Included in operational costs

Annex 2. Monitoring Plan

This monitoring plan will be used to determine compliance with the Environmental Management Plan (Appendix A).

Mitigation measures	Monitoring indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
Construction Phase				
Soil excavated from trenches is piled in the relatively smooth and vegetation free areas, and is used for backfilling after pipe laying	Visual appearance of earth work sites	During earth works	Visual inspection	PIU through Technical Supervisor, Armavir Municipality
Construction vehicles move along the existing local roads or temporary access roads, not passing through earth surface in an unregulated manner	Visual appearance of earth surface in and around construction sites	Throughout construction period	Visual inspection	PIU through Technical Supervisor, Armavir Municipality
No quarries are operated without Contractor's valid license (unless material is purchased from a vendor), and sections of quarries reinstated upon completion of extraction	Presence of licenses, Inspection of quarries	During extraction	Verification of licenses; Checking compliance with license conditions; Visual inspection of quarry sites	PIU through Technical Supervisor, RA Ministry of Nature Protection State Environmental Inspection
Excess soil is used for leveling the existing earth road and/or disposed in another location agreed with the local government	Visual appearance of soil disposal sites; Agreement documents	During and after completion of earth works	Visual inspection	PIU through Technical Supervisor, Armavir Municipality

Mitigation measures	Monitoring indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
On-site management of construction materials and waste	Construction materials and waste are stored in special designated locations within work sites; No excessive amounts of construction waste are accumulated on-site Signs and posters on construction site, with relevant info.	Throughout construction works	Visual inspection	PIU through Technical Supervisor,
The lubricants and other oil products are properly stored and kept at a special designed confined location or are handed over to specialized service provider	Visual inspection of conditions at construction site and adjacent area; Hand-over documents	Throughout construction works once a month	Visual inspection	PIU through Technical Supervisor, Ministry of Nature Protection, Ministry of Health
Covered trucks are used for transporting construction materials and waste	Condition of trucks	Throughout construction period	Visual inspection along transport routes	PIU through Technical Supervisor, Road Inspection
Dust control through sprinkling of work sites	Conditions at work sites	During the construction in dry weather	Visual inspection	PIU through Technical Supervisor
Vehicles are in adequate technical condition and equipped with mufflers	Technical conditions of vehicles	Daily	Sound level meter	PIU through Technical Supervisor, Ministry of Nature Protection, Ministry of Health
Verification of the availability of gender-sensitive employment opportunities by the contractor	Availability of temporary employment opportunities for both female and male community members	During construction	Checking the contractor's monthly/quarterly reports	PIU and PIU Technical Supervisor

Mitigation measures	Monitoring indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
Observing the workers' health and safety standards	Workers are equipped with and use personal safety gear; Personnel operating complex machinery has received adequate training; Work sites are supplied with the first aide medical kits and fire extinguishing equipment; No serious work-related accidents occurred.	During construction	Visual inspection, Review of personnel training records and licenses held for operation of machinery	PIU through Technical Supervisor
Establishment of a viable grievance redress mechanism to address questions and complaints of affected population	Posters with the name and contacts of Contractor available at work sites; Local communities confirm absence of complaints, or confirm that they were able to voice their concerns and receive satisfactory solutions. Existence of grievance logs in the communities.	Throughout construction	Visual inspection, Inquiry of local communities	PIU through Technical Supervisor Directly the PIU
Work site reinstatement by removal of residual waste, topsoil backfilling, leveling and landscaping	Construction corridor restored to the original state; No residual amounts of construction materials and waste and no trash found on site.	Final phase of construction activity on site	Visual inspection	PIU through Technical Supervisor, Directly the PIU
Operation stage				

Mitigation measures	Monitoring indicators	Time / Frequency of Monitoring	Monitoring Methods	Monitoring organization
Regular maintenance of hydraulic structures and pipes/canals of the system Dam structural safety—construction and post-construction surveys	Hydraulic structures and pipes/canals of the system are in good working condition; No congestion of the system and no flooding of command area occurs	Throughout operation of the system	Visual inspection Instrumental methods	SCWE
Revealing signs of a dramatic deterioration of water quality and discontinuing water supply till water is proven safe for irrigation	No cases of pollution of agricultural fields and contamination of produce due to accidental pollution of water sources	Throughout operation of the system	Visual inspection Instrumental methods	WUA, MoNP
Conduct public awareness campaign and provide agro-extension services on safe use of pesticides and application of IPM system	Improved irrigation service provision does not result in damage to soils and public health due to excessive or otherwise unsafe use of pesticides	Throughout operation of the system	Data on the quality of soils and agricultural produce	Ministry of Agriculture Amelioration LLC MoNP

Annex 3. Accident Report Form

Mastara reservoir construction

1	Date	
2	Gravity system section	
3	Location	
4	Construction contractor	
5	Marz (region)	
6	Water supply agency/WUA	
7	Accident type	
8	Severity	□ High □ Medium □ Low
9	Reported by	
10	Accident main reason description	
11	Corrective measures taken	
12	Corrective measures to be taken	
13	Corrective measures taken to prevent recurrence	
14	Corrective measures taken by	
15	Eliminated by	
16	Elimination date	
17	Person Involved	
18	Equipment involved	
19	Contractor/subcontractor involved	
20	Third party involved	
21	Relevant photos	*The photos with appropriate descriptions should be presented as an Attachment to the Incident Report*

For WSPIU only

Date	
Received by	
Decision/action taken	

Annex 4. Affected community agreements

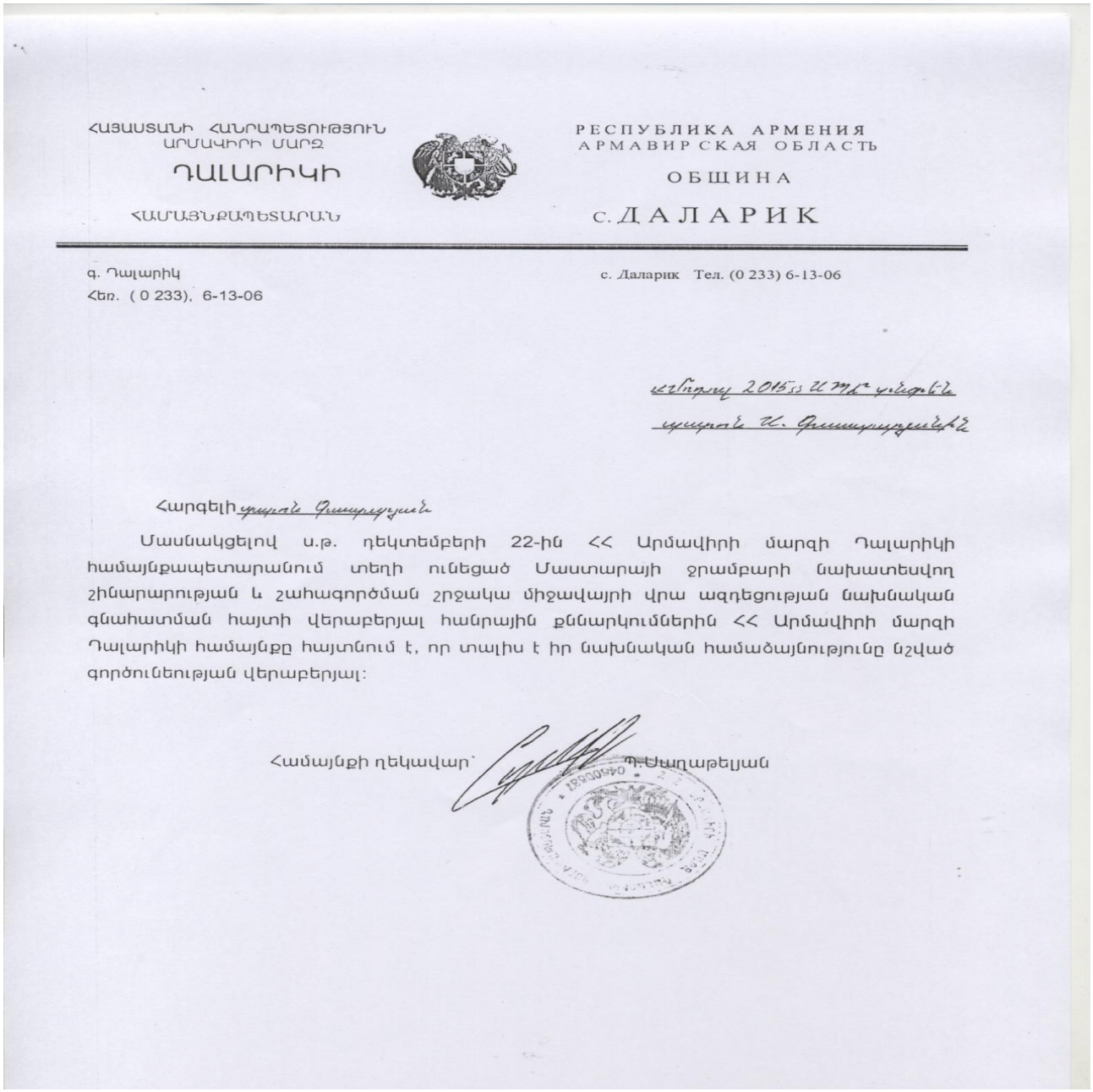
Dalarik Municipality

Dear Mr. Gasparyan,

Having participated in public consultations for application to initiate preliminary assessment of environmental impact of Mastara reservoir construction and operation in Dalarik Municipality on December 22, 2017, Dalarik community of the RA Armavir Marz provides its preliminary agreement for the planned activities.

P.Saghatelyan

Head of Community



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РЕСПУБЛИКА АРМЕНИЯ
АРМАВИРСКАЯ ОБЛАСТЬ
ОБЩИНА
С. ДАЛАРИК

գ. Դալարիկ
հեռ. (0 233), 6-13-06

с. Даларик Тел. (0 233) 6-13-06

Հարգելի պրն. Գասպարյան

Մասնակցելով ս.թ. դեկտեմբերի 22-ին <<Արմավիրի մարզի Դալարիկի համայնքապետարանում տեղի ունեցած Մաստարայի ջրամբարի նախատեսվող շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի վերաբերյալ հանրային քննարկումներին <<Արմավիրի մարզի Դալարիկի համայնքը հայտնում է, որ տալիս է իր նախնական համաձայնությունը նշված գործունեության վերաբերյալ:

Համայնքի ղեկավար՝ Պ.Սաղաթելյան

Lernagog Community Mayor

Dear Mr. Gasparyan,

Having participated in public consultations for application to initiate preliminary assessment of environmental impact of Mastara reservoir construction and operation in Lernagog Municipality on December 22, 2017, Lernagog community of the RA Armavir Marz provides its preliminary agreement for the planned activities.

P.Saghatelyan

Head of Community

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅԱՆ ԱՐՄԱՎԻՐԻ ՄԱՐԶԻ ԼԵՌՆԱԳՈԳ
ՀԱՄԱՅՆՔԻ ՂԵԿԱՎԱՐ

Հայաստանի Հանրապետության Արմավիրի մարզի Լեռնագոգ համայնք
ՀՀ, Արմավիրի մարզ, գ.Լեռնագոգ, 094-34-34-08, lernagog.armavir@mta.gov.am

Հարգելի պարոն Գասպարյան

Մասնակցելով ս.թ. դեկտեմբերի 22-ին ՀՀ Արմավիրի մարզի Լեռնագոգի միջնակարգ դպրոցի դահլիճում տեղի ունեցած Մաստարայի ջրամբարի նախատեսվող շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի վերաբերյալ հանրային քննարկումներին ՀՀ Արմավիրի մարզի Լեռնագոգի համայնքը հայտնում է, որ տալիս է իր նախնական համաձայնությունը նշված գործունեության վերաբերյալ:

ՀԱՄԱՅՆՔԻ ՂԵԿԱՎԱՐ՝ ՍԱՐԳԻՍ ՄԱՐԳԱՐՅԱՆ

2017թ.դեկտեմբերի 22
գ.Լեռնագոգ

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Annex 6. Records of Public Consultation

MINUTES

of First Public Consultations of Mastara Reservoir Construction Project

in Dalarik community of the RA Armavir Marz, on December 22, 2017

Rostam Sahakyan Made an opening speech presenting the objective and participants of the Meeting. It has been noted, that the community was aware of the Mastara Reservoir Construction Project as the Project experts regularly visited the community and carried out the interviews and that the Project was welcomed. Nevertheless, the more detailed presentation of the Project by its implementers is welcomed. Then, he passed the floor to the PIU representative.

Martiros Nalbandyan Welcomed the Meeting participants and mentioned that the main objective of the Meeting is to discuss the Mastara Reservoir Construction Project Draft ESIA Report, to notify the affected community on the territory of which are implemented the activities, i.e. the feasibility study, environmental and socio-economical, as well as resettlement teams works. It has been mentioned that the Project works will be implemented in 3 stages, and the present stage is the feasibility stage. It has also been mentioned that the consultations are carried out in accordance with international and national legislation requirements, particularly, the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Issues of 1998 and the RA Law On Environmental Impact Assessment and Expertise of 2014. As this consultation is the first and initial out of the 4 envisaged consultations, its objective is to notify the community on the idea, listen the concerns of the community representatives and suggestions on potential problems redress, which will be taken into account in the design stage, if appropriate.

Vram Tevosyan Presented the Company and the Expert Team, which is carrying out the Project ESIA works in line with the international and national legislation, moreover, the Aarhus Convention requires providing environmental awareness of the affected groups in the early stage of Project development. It has been mentioned, that the objective of the Project is the water resources conservation, significantly reducing the Ararat Valley water intake, which, in turn, would result in serious environmental changes. The main sections of the ESIA Report, survey results, description of the areas potentially related to the Project and the possible Project implementation impact on those areas were presented. In frameworks of ESIA works, legal framework analyzes and baseline survey were carried out, and the potential impacts of the Project on land, flora and fauna were assessed, moreover, it has been assessed as low – minimal impact. At the same time, he informed that these impacts, their mitigation measures and agencies responsible for the implementation of mitigation measures are mentioned in the Environmental Management Plan annexed to the ESIA Report. In the framework of ESIA works, socio-economic impact assessment has also been carried out, and it will be presented in details by the Team Social Expert.

Marine Vardanyan Thanked the ESIA Consultants for the efficient works implemented and underscored the necessity and importance of social assessment in the frame of ESIA works. She briefly presented the social assessment results, the Project Grievance Redress Mechanisms, including the contacts of the PIU grievance responsible persons and provided the Grievance and Feedback Log to the Community Administration, mentioning that it will be accessible for all willing to submit a grievance or feedback.

Emma Mkrtchyan Presented the applied Project social impact assessment methodology on affected and beneficiary communities, i.e. the social surveys, including the qualitative surveys and socio-economic analysis. The in-depth interviews were carried out with the Mayors of all the affected and beneficiary communities, as well as with the representatives of the Shenik, Talin and Armavir Water User Associations (WUAs) in order to reveal through the qualitative surveys the community concern irrigation sector problems and the potential negative Project impacts. In each community 2 focus group discussions were carried out with women, landowners and representatives of vulnerable groups in order to reveal the concerns and needs of various community groups and to find out their expectations from Reservoir Construction Project. It has been noted, that the affected and beneficiary community Mayors and population have mainly positive

perceptions from the Mastara Reservoir Construction Project, and the Project's positive social impact in operation phase is obvious for all, i.e. promoting mitigation of migration rates, agriculture development and poverty reduction. The possible inconveniences of construction phase and their mitigation measures were also mentioned, including the possibility of short term jobs in construction sector (even for women, who can work as cooks and cleaners, if unwilling to perform other works). The permanent and temporary land use issues were presented.

Martiros Nalbandyan Suggested the Meeting participants to present the design related environmental and social issues which they are interested in.

Then there were exchange of opinions, questions and answers

Question

Samvel Shahbazyan Will the demolition works be permitted during construction?

Answer

Vram Tevosyan It is the donors' requirement to avoid demolition works as far as possible; nevertheless, if required, they will be implemented according to the relevant standards. But it is too early to speak about it at this stage.

Question

Hrant Soghomonyan Will the dam seismicity be provided?

Answer

Vram Tevosyan The answer to that, as well as to other technical questions, will be provided in details in the design.

Addendum

Martiros Nalbandyan The subsoil geological and other surveys were carried out and several versions of the design presented, so they will be discussed during the next consultations.

Question

Karlos Grigoryan Please, introduce your Company.

Answer

Vram Tevosyan Though we have introduced ourselves and presented the objective of the meeting at the beginning, I will do that once again, as you joined us late: "Consecoard LLC is implementing the Mastara Reservoir Construction Project ESIA works ordered by the WSPIU".

Question

Tatul Vardanyan When the commissioning of the reservoir is envisaged?

Answer

Vram Tevosyan It is too early to speak about it at this stage.

Question

Karen Movsisyan Is Akna Lich privatized or is it under the State control?

Answer

Martiros Nalbandyan Akna Lich is under the State control.

Question

Gagik Grigoryan How it comes that during the USSR period the Akhuryan lake water was sufficient for irrigation, and now – it is not, though there are less areas to be irrigated due to the absence of many residents from the communities.

Answer

Martiros Nalbandyan Akhuryan lake is partially filled from Turkey, and as our neighbor country has constructed a number of reservoirs and catches part of waters in its territory, it is the reason the lake is not being filled. In order to mitigate those risks, we will try to construct the Kaps reservoir in Shirak marz, on the right bank of Akhuryan river, and will try to restore the Arpi lake reservoir.

Question

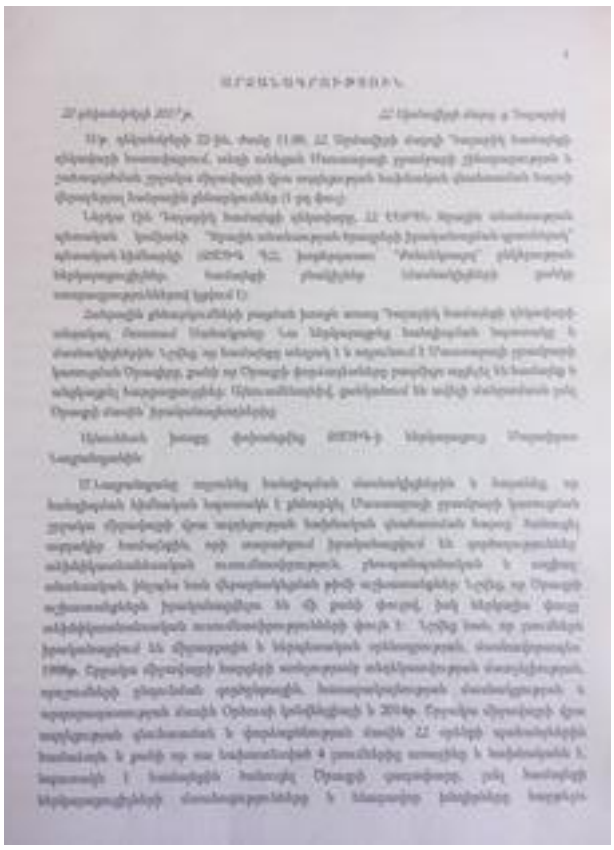
Pavlik Manukyan Why is Dalarik the affected and not the beneficiary community?

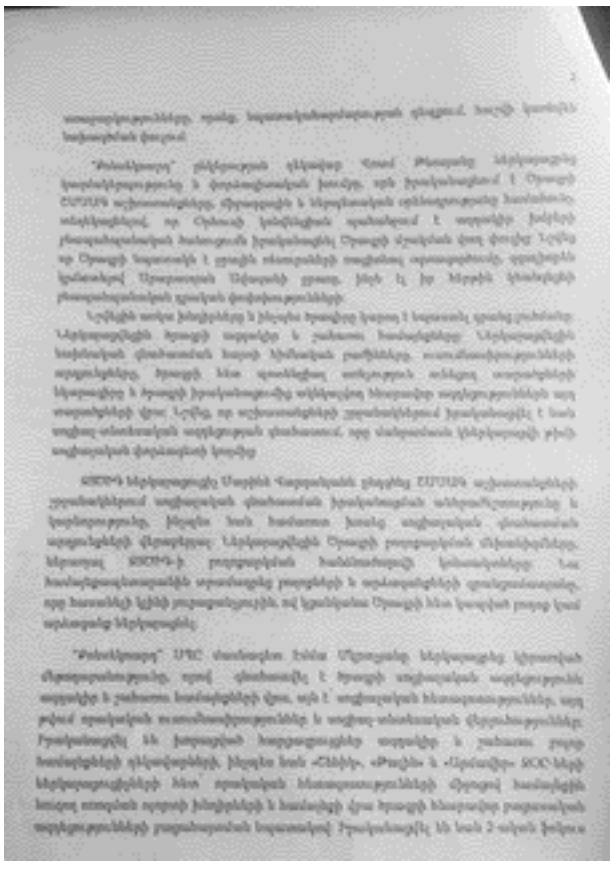
Answer

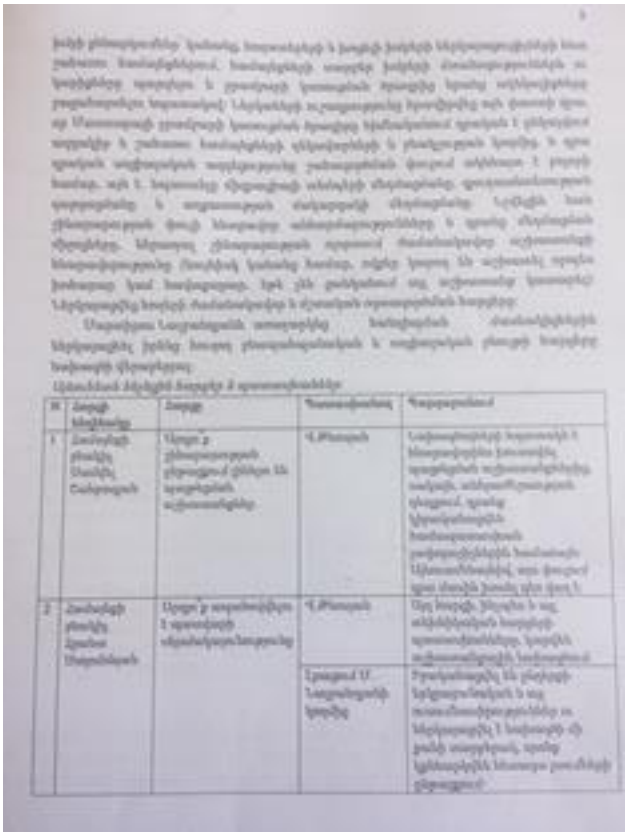
Vram Tevosyan Though Dalarik is not a beneficiary community as per Project design, you will also benefit to some extent from the Project, in a way our Social Expert has already mentioned during the presentation of the socioeconomic impact assessment results.

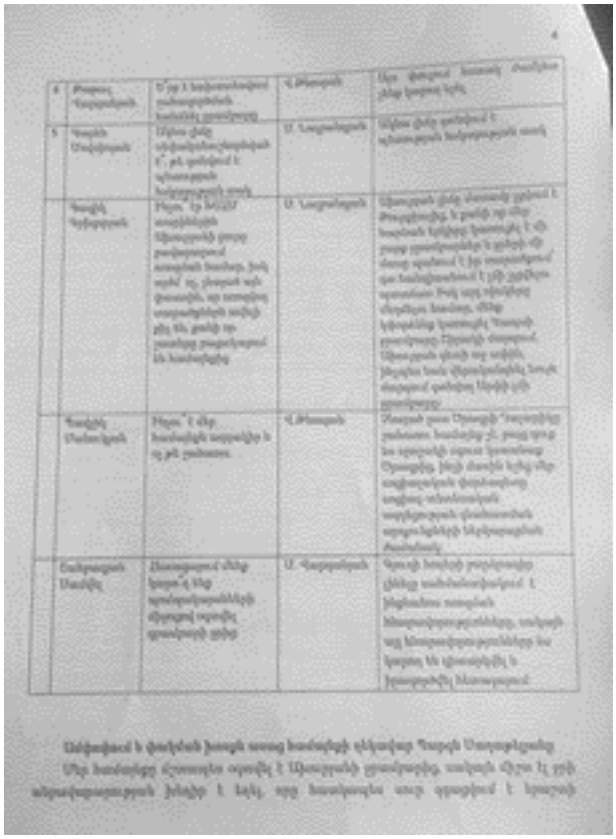
Summary and closing remarks

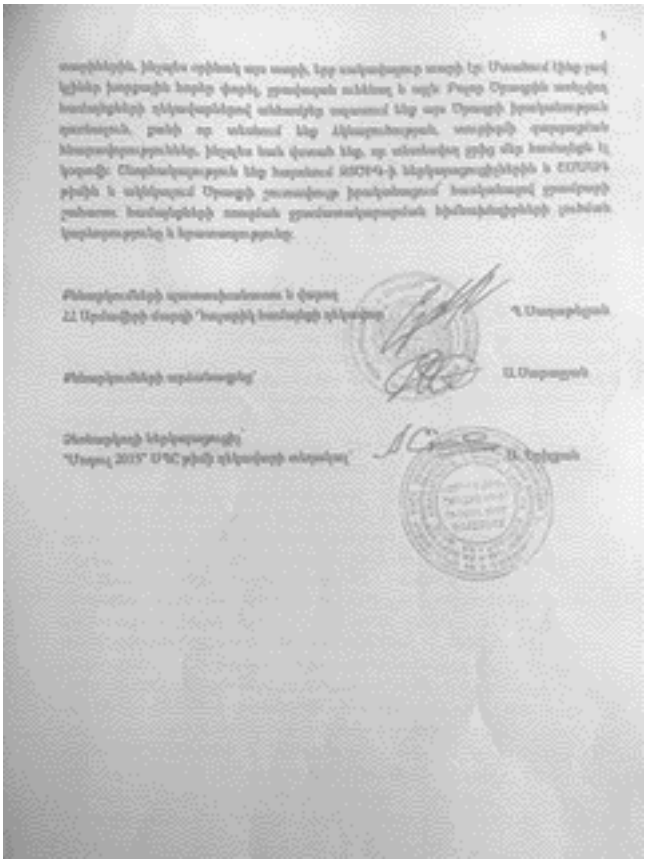
Pargev Saghatelyan Our community had always been using the Akhuryan reservoir, though there had always been a water shortage problem, which was specifically acute during the drought, such as during this year, as it was water-short year. We thought it would have been good to dig deep wells, to have ponds, etc. We, all the Project related Community Mayors, are very much looking forward to this Project implementation, as we see the possibility for the development of fishery and tourism, and we are confident that our community will also benefit from the water savings. We would like to thank the PIU representatives and ESIA Team and we are looking forward to this Project soonest implementation, understanding the importance and urgency of the solution of reservoir beneficiary communities irrigation water supply issues.











List of Participants

Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի վերաբերյալ հանրային քննարկումների (1-րդ փուլ) նիստի մասնակիցների

ՑՈՒՑԱԿ

ՀՀ Արմավիրի մարզ, գ. Դալարիկ 22.12.2017

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MINUTES

Of First Public Consultations of Mastara Reservoir Construction Project Draft ESIA Report

In Lernagog community of the RA Armavir Marz, on December 22, 2017

Aleksandr Davtyan Made an opening speech, presenting the objective of the Meeting and the importance of providing the Project awareness for the community population. Then, he passed the floor to the PIU representative, asking to present in details, among other issues, the area envisaged for the construction of the reservoir.

Martiros Nalbandyan Welcomed the Meeting participants and mentioned that the main objective of the Meeting is to discuss the Mastara Reservoir Construction Project Draft ESIA Report, to notify the affected community on the territory of which are implemented the activities, i.e. the feasibility study, environmental and socio-economical, as well as resettlement teams works. It has been mentioned that the Project works will be implemented in 3 stages, and the present stage is the feasibility stage. It has also been mentioned that the consultations are carried out in accordance with international and national legislation requirements, particularly, the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Issues of 1998 and the RA Law On Environmental Impact Assessment and Expertise of 2014. As this consultation is the first and initial out of the 4 envisaged consultations, its objective is to notify the community on the idea, listen the concerns of the community representatives and suggestions on potential problems redress, which will be taken into account in the design stage, if appropriate.

Vram Tevosyan Presented the Company and the Expert Team, which is carrying out the Project ESIA works in line with the international and national legislation, moreover, the Aarhus Convention requires providing environmental awareness of the affected groups in the early stage of Project development. It has been mentioned, that the objective of the Project is the water resources conservation, significantly reducing the Ararat Valley water intake, which, in turn, would result in serious environmental changes. The main sections of the ESIA Report, survey results, description of the areas potentially related to the Project and the possible Project implementation impact on those areas were presented. In frameworks of ESIA works, legal framework analyzes and baseline survey were carried out, and the potential impacts of the Project on land, flora and fauna were assessed, moreover, it has been assessed as low – minimal impact. At the same time, he informed that these impacts, their mitigation measures and agencies responsible for the implementation of mitigation measures are mentioned in the Environmental Management Plan annexed to the ESIA Report. In the framework of ESIA works, socioeconomic impact assessment has also been carried out, and it will be presented in details by the Team Social Expert.

Marine Vardanyan Thanked the ESIA Consultants for the efficient works implemented and underscored the necessity and importance of social assessment in the frame of ESIA works. She briefly presented the social assessment results, the Project Grievance Redress Mechanisms, including the contacts of the PIU grievance responsible persons and provided the Grievance and Feedback Log to the Community Administration, mentioning that it will be accessible for all willing to submit a grievance or feedback.

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poverty reduction. The possible inconveniences of construction phase and their mitigation measures were also mentioned, including the possibility of short term jobs in construction sector (even for women, who can work as cooks and cleaners, if unwilling to perform other works). The permanent and temporary land use issues were presented.

Martiros Nalbandyan Suggested the Meeting participants to present the design related environmental and social issues which they are interested in.

Then there were exchange of opinions, questions and answers

Statement

Koryun Makaryan There is no waterfall, or there is once a year, if any.

Answer

Vram Tevosyan We have already taken samples from the waterfall and will make another sampling in Spring, as it is our responsibility to survey the water quality.

Statement

Gor Galstyan As there is a training ground in the vicinity, we are used to the noise, shootings, dust, so we do not have any concern about the temporary construction impacts, i.e. dust, noise, etc., moreover, the construction will be implemented far away from the settlements. Nevertheless, due to the mentioned training ground, we are preoccupied by the reservoir safety issues, as during the exercises there are shootings, with the noise and vibration caused by those shootings being so strong, that we are even afraid of the houses' windows to be broken. Therefore, we are concerned about the reservoir safety issue.

Answer

Martiros Nalbandyan We will record the problem raised by you and will send it to the responsible parties, besides, during our next Consultations, the design company representatives will be also present and will reply to this and other technical questions.

Question

Aleksandr Davtyan Have the donors visited the communities and carried out relevant surveys and public consultations to reveal the benefits of the reservoir for the affected communities, and to select such location for the reservoir, which will allow Dalarik and Lernagog communities' lands also to be irrigated from the reservoir, at least partially.

Answer

Marine Vardanyan Yes, the donors have 3-4 times visited the communities and carried out a number of surveys, including the location surveys.

Answer

Martiros Nalbandyan Choosing the area for reservoir basin is not an easy process. If certain area is selected, it means specifically that area is suitable for allocating the reservoir basin of the certain size. Moreover, the area has been selected in a result of survey of the whole Selav-Mastara area.

Question

Aleksandr Nalbandyan Could it be that after construction of the reservoir the irrigation water supply problems of our community will be ignored, considering the community problems to be already resolved.

Answer

Martiros Nalbandyan It is impossible. There is a water management issue, which shall be discussed with the responsible Water Intake and WUA.

Question

Koryun Makaryan Isn't it possible to change the area of the reservoir location selected based on the results of surveys carried out about 80 years ago, and to provide, for example, reservoir with smaller basin area but with higher marks, providing also gravity irrigation of Lernagog community area, or at least, a part of its area. Will our concerns and problems raised reach the responsible parties?

Answer

Martiros Nalbandyan The reservoir location, as already mentioned, has been selected based on relevant surveys, and what we can promise today is that the Talin WUA will direct excess waters to your community. As for the issues and problems raised by you, they are recorded by us and will be submitted to the responsible parties. In addition, during our next consultations, the representatives of design company will be present and will answer all the technical questions.

Statement

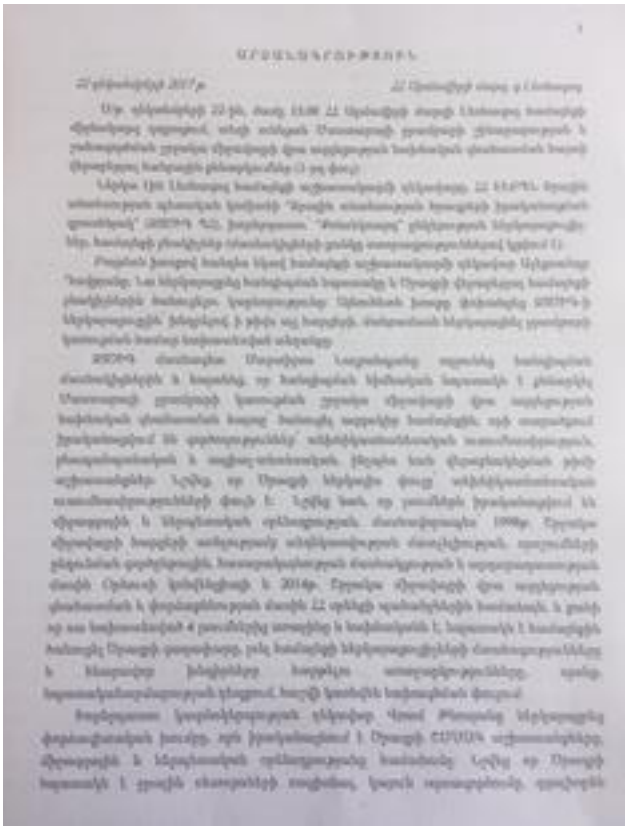
Gor Galstyan It's been envisaged that Talin WUA will provide the irrigation of about 2200 ha, therefore presently the WUA is unable to provide the irrigation of the area 10 times bigger than that envisaged.

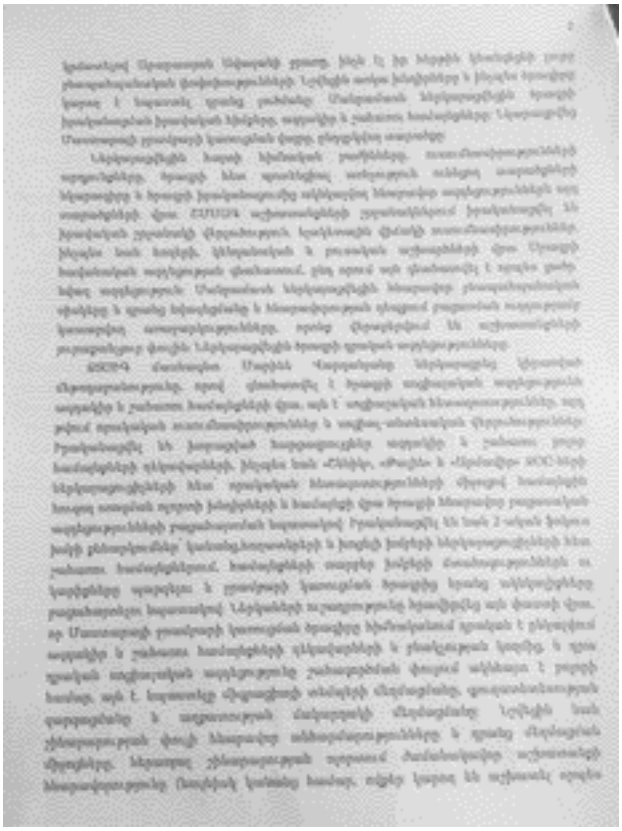
Answer

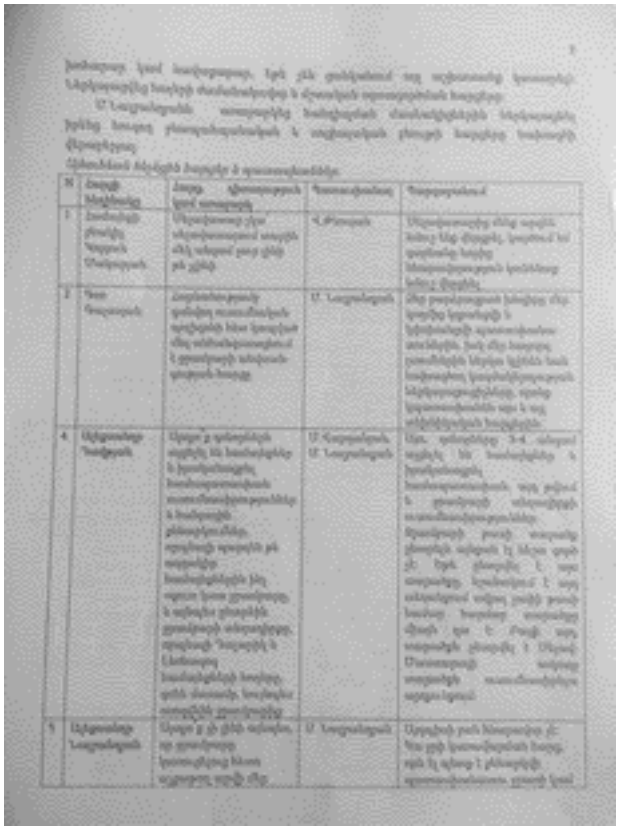
Vram Tevosyan During our next consultations the representatives of the design company and the Ministry of Nature Protection will participate, thus you will have an opportunity to ask your questions directly.

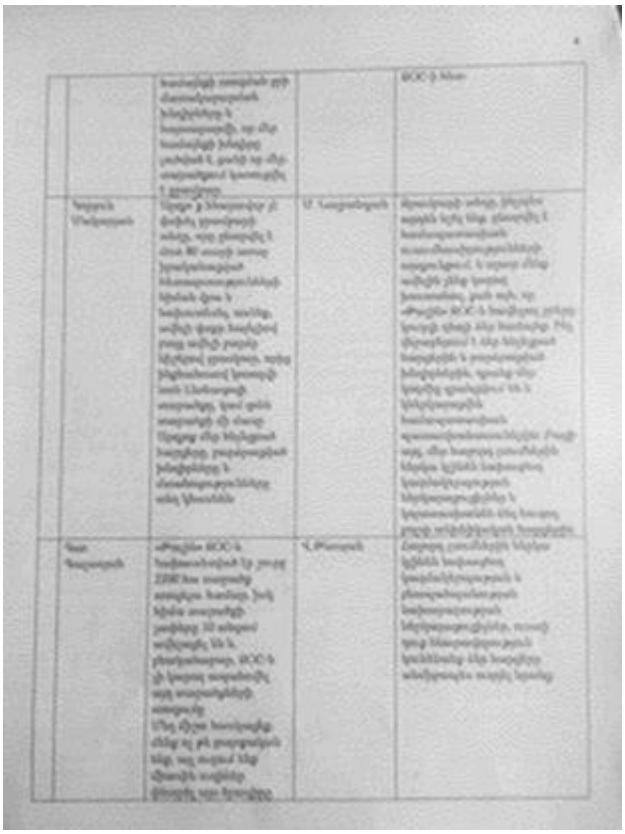
Summary and closing remarks

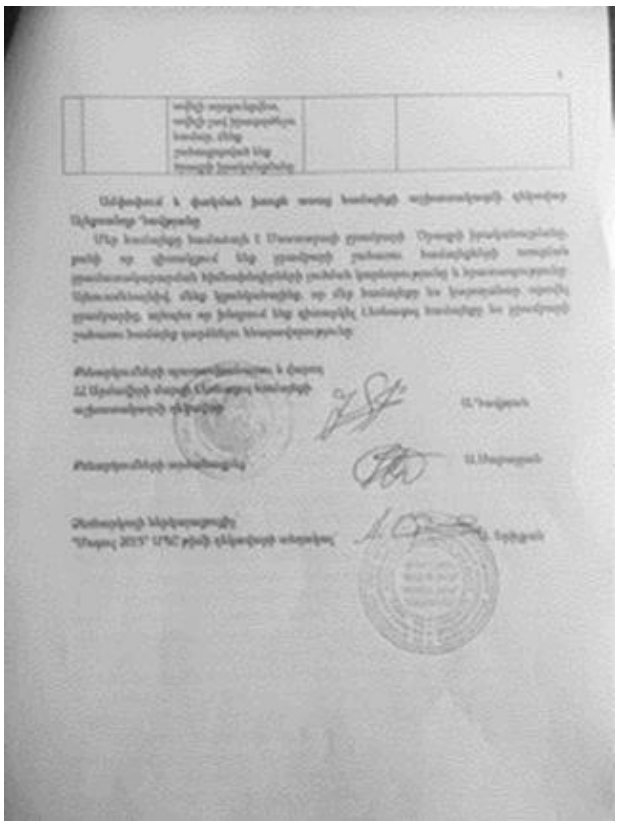
Aleksandr Davtyan Our community agrees to the implementation of the Mastara Reservoir Project, as we understand the importance and urgency of solution of the irrigation water supply problems of the reservoir beneficiary communities. Nevertheless, we would like our community also to benefit from the reservoir, therefore we ask you to consider the issue of Lernagog community also being the reservoir project beneficiary.











List of Participants

Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի վերաբերյալ հանրային քննարկումների (1-րդ փուլ) նիստի մասնակիցների

ՑՈՒՑԱԿ

ՀՀ Արմավիրի մարզ, գ. Լեռնագոգ 22.12.2017

Անուն Ազգանուն	Կազմակերպություն կամ բնակության վայր	Կոնտակտային տվյալներ	Ստորագրություն
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MINUTES

of Second Public Consultations of Mastara Reservoir Construction Project

in Dalarik community of the RA Armavir Marz, on February 06, 2018

Pargev Saghatelyan Made an opening speech presenting the objective and participants of the Meeting. It has been noted, that it was the second time for the community to participate in public consultations of the Mastara Reservoir Construction Project Environmental and Social Impact Assessment, and, as it was already mentioned before, Dalarik community welcomes and is looking forward to the soonest implementation of the Project. Then, he passed the floor to the Consecoard LLC Director, Expert Team Leader Vram Tevosyan.

Vram Tevosyan Presented the Company and the Expert Team, which is carrying out the Project ESIA works. It has been mentioned, that these public consultations were the second out of the four consultations mandatory for the initial assessment application stage, and in the stage following the initial assessment application stage, i.e. in the expertise stage implemented based on the tasks assigned by the Ministry of Nature Protection, more in-depth surveys will be carried out and there will be more accurate figures and indicators. In addition, the Environmental and Social Management Plan with mitigation measures will be prepared. It has been mentioned, that the environmental impact of the Project is assessed as low – minimal impact, while there is the positive social impact expected. He passed the floor to the Chief Specialist of the Center of Expertise for Environmental Impact Assessment Karine Movsisyan.

Karine Movsisyan Presented the legislation framework related to the environmental impact assessment and the objective of the meeting. She mentioned that the initial assessment application related to the Mastara reservoir project activities is presented at the consultations. It has been reiterated that the environmental impact of the Project is expected to be low – minimal. She also noted, that the initial agreement of the community was received to implement the Mastara reservoir project related activities on the administrative area of the community, and this stage will be followed by the expertise stage during which the solutions will be given to the technical tasks assigned by the Ministry of Nature Protection. Then, Karine Movsisyan encouraged community representatives to voice all the issues related to the environmental and social impacts they have concerns about, so that they are addressed in the expertise stage.

Marine Vardanyan Presented the necessity and importance of the social assessment in the frame of ESIA works, and briefly introduced the social impact assessment results. It has been mentioned, that though Dalarik community was not the direct beneficiary of the Mastara reservoir, during the interviews, the community irrigation problems were revealed and it was negotiated with Shenik WUA that the savings of water from Miasnikyan community being provided with water from the reservoir to be directed to Dalarik community for its irrigation purposes. The potential social impacts during the construction stage were also presented with their mitigation measures. It's been noted that the cases of resettlement are expected during the Project implementation and the detailed presentation about it will be made by Emma Mkrtchyan. The Project Grievance Redress Mechanisms were presented again, including the contacts of the PIU grievance responsible persons, mentioning that the scopes of these mechanisms will be enhanced during the Project implementation stage.

Then there was an exchange of opinions, questions and answers

Statement

Pargev Saghatelyan The community is the beneficiary of the reservoir, as about 60-70 ha of its lads will be irrigated from it.

Question

Karine Movsisyan What is the approximate size of the area to be used for the reservoir?

Answer

Martiros Nalbandyan The answer to that question will be provided by the design company representative, who, as promised during our previous visit, is present today at these consultations to answer the design and construction related questions the community is concerned about.

Answer

Asatur Yeritsyan

The reservoir dam and basin will occupy about 64 ha area, of which about 60% is in the administrative area of Dalarik community.

Question

Gagik Grigoryan Is it possible to construct pumping stations on the reservoir or to raise canals in order to make use of the reservoir.

Answer

Martiros Nalbandyan The pumping stations are too power-consuming, therefore it is not justified to construct the reservoir and to install pumping stations on it.

Addendum

Pargev Saghatelyan There is no issue of raising the canals in our community, there is problem of correct water distribution by the WUA only.

Question

Hrant Soghomonyan The canals constructed in Dalarik in the 60th do not have the sufficient capacity for the additional irrigation waters, so how this problem will be addressed?

Answer

Karine Movsisyan This is only the initial stage, the questions like that will be discussed at the stage of detailed design.

Addedum

Martiros Nalbandyan In all the projects submitted by us, the attention is paid to the rehabilitation and/or construction of internal network and access canals, therefore, it is the mandatory next stage, if necessary.

Question

Hrant Soghomonyan You are providing compensations for private lands, but what about the community owned lands, will they also be compensated for?

Answer

Martiros Nalbandyan The community is also entitled for compensation against its lad if willing to receive such.

Question

Slavik Poghosyan When will the construction of the reservoir commence?

Answer

Asatur Yeritsyan Our works will be completed around April-May, and after that the relevant decision will be made.

Addendum

Marine Vardanyan The construction will commence only if its necessity is justified in the feasibility stage.

Question

Gagik Grigoryan What will be the approximate capacity of the reservoir, which water flows will feed it, as it is known that the reservoirs constructed in Turkey significantly reduce our water flows, and the mudflows occur only few times a year.

Answer

Asatur Petrosyan The envisaged capacity is 7,5 cubic meters, in November-December it will be provided by Talin irrigation network, and during the rest of the year – it will be provided at the account of our part of Akhuryan river. In addition, we have unmanageable flows, and the construction of the reservoir solves the problem of those unmanageable flows.

Question

Gagik Grigoryan Akhuryan river flows have not be seen during non-irrigation season, which flows are those?

Answer

Asatur Yeritsyan Those flows enter and are accumulated in the Akhuryan reservoir.

Clarification

Karine Movsisyan It means the reservoir has 2 feeds –Akhuryan reservoir and the mudflow.

Addendum

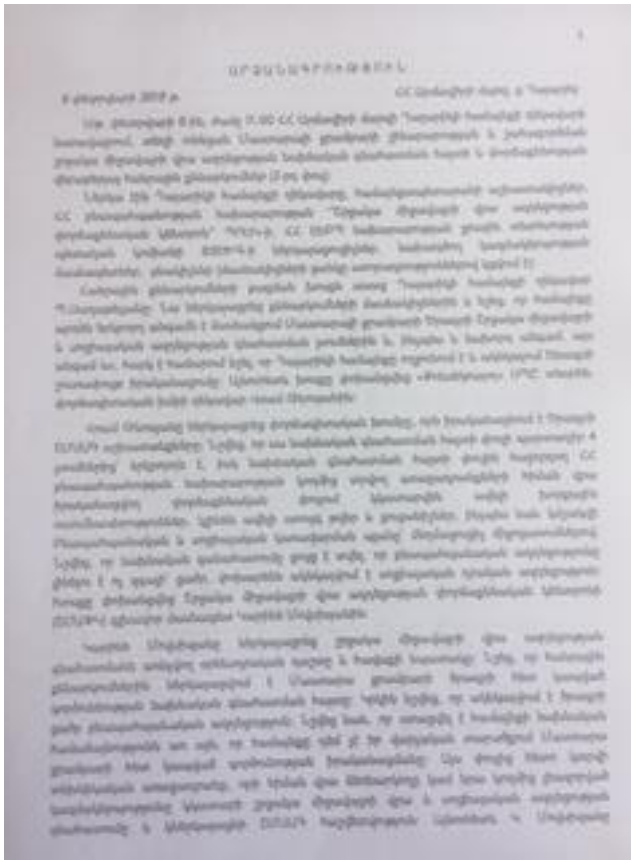
Martiros Nalbandyan During the recent years, we feed the Akhuryan reservoir in excess, therefore it is very important to bring waters here, because the 7,5 million cubic meters water brought here is ours and the water which is there – is not.

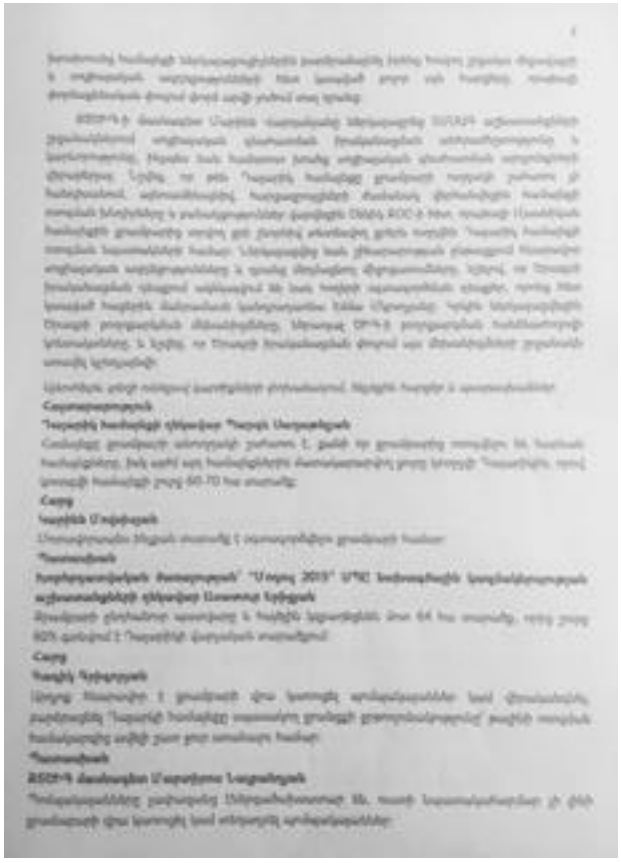
Statement

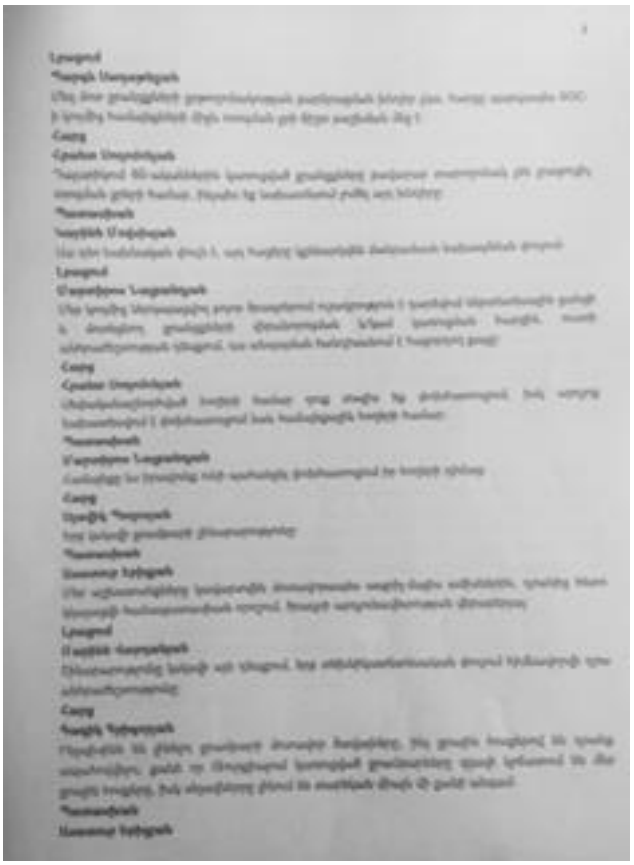
Vram Tevosyan Our works are based on calculations and observations and not good wishes.

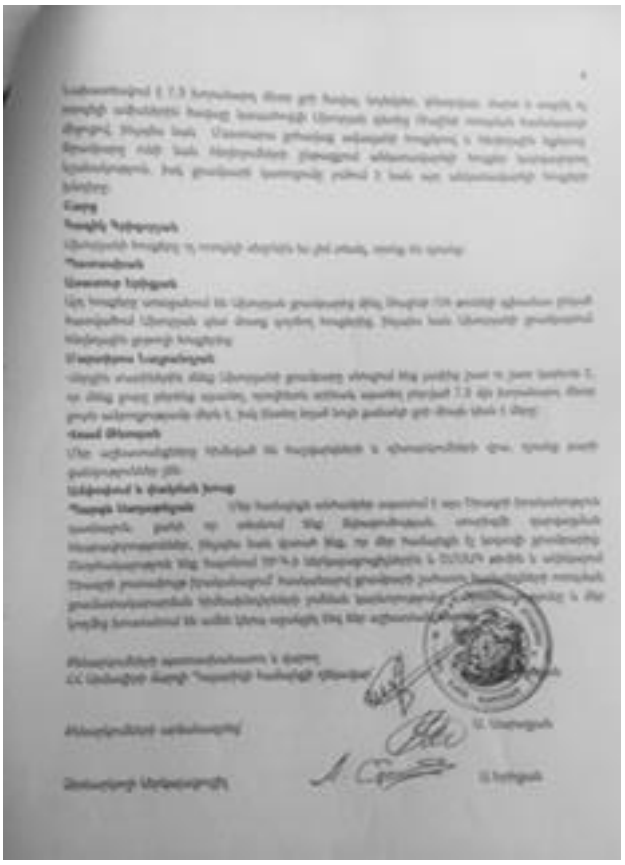
Wrap-up and closing remarks

Pargev Saghatelyan Our community is looking forward to the implementation of this Project, as we see the potential for the development of fishery and tourism, as well as believe that our community will also make use of the reservoir. We would like to thank the PIU representatives and ESIA Team and we are looking forward to soonest implementation of this Project, understanding the importance and urgency of the solution of reservoir beneficiary communities irrigation water supply issues. We express our willingness and readiness to support in the preparation and implementation of the Project.









List of Participants

Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի և փորձաքննության վերաբերյալ հանրային քննարկումների (2-րդ փուլ) նիստի մասնակիցների

ՑՈՒՑԱԿ

ՀՀ Արմավիրի մարզ, գ. Դալարիկ 6.02.2018

Անուն Ազգանուն	Կազմակերպություն կամ բնակության վայր	Կոնտակտային տվյալներ	Ստորագրություն
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MINUTES

of Second Public Consultations of Mastara Reservoir Construction Project

in Lernagog community of the RA Armavir Marz, on February 06, 2018

Sargis Margaryan Made an opening speech presenting the objective and participants of the Meeting. It has been noted, that despite the fact that Lernagog community is not the reservoir Project beneficiary, it welcomes and is looking forward to the implementation of the Project. Then, he passed the floor to the Consecoard LLC Director, Expert Team Leader Vram Tevosyan.

Vram Tevosyan Presented the Company and the Expert Team, which is carrying out the Project ESIA works. It has been mentioned, that these public consultations were the second out of the four consultations mandatory for the initial assessment application stage, and in the stage following the initial assessment application stage, i.e. in the expertise stage implemented based on the tasks assigned by the Ministry of Nature Protection, more in-depth surveys will be carried out and there will be more accurate figures and indicators. In addition, the Environmental and Social Management Plan with mitigation measures will be prepared. It has been mentioned, that the environmental impact of the Project is assessed as low – minimal impact, while there is the positive social impact expected. He passed the floor to the Chief Specialist of the Center of Expertise for Environmental Impact Assessment Karine Movsisyan.

Karine Movsisyan Presented the legislation framework related to the environmental impact assessment and the objective of the meeting. She mentioned that the initial assessment application related to the Mastara reservoir project activities is presented at the consultations. It has been reiterated that the environmental impact of the Project is expected to be low – minimal. She also noted, that the initial agreement of the community was received to implement the Mastara reservoir project related activities on the administrative area of the community, and this stage will be followed by the expertise stage during which the solutions will be given to the technical tasks assigned by the Ministry of Nature Protection.

It has also been mentioned that it became known that there was an element of occurrence of the historical and cultural place therefore the designers would be assigned a task to carry out additional surveys, the results of which will be presented to the authorized agency.

Then, Karine Movsisyan encouraged community representatives to voice all the issues related to the environmental and social impacts they have concerns about, so that they are addressed in the expertise stage.

Marine Vardanyan Presented the Project Grievance Redress Mechanisms, including the contacts of the PIU grievance responsible persons, mentioning that the scopes of these mechanisms will be enhanced during the Project implementation stage.

Emma Mkrtchyan Presented the results of the social impact assessment works, including the potential social impacts during construction stage. It's been mentioned that in case of the Project implementation the resettlement is expected, and the issues related to the resettlement will be covered in details during the presentation on the Resettlement Action Plan for the Mastara Reservoir Construction Project.

Then there was an exchange of opinions, questions and answers

Statement

Sargis Margaryan Apart from the Mastara reservoir, we proposed construction of another reservoir on the same Mastara mudflow but on the higher altitudes and with larger capacity, which will be fed from the same flow. Costing about 20-25 million AMD, that reservoir will provide the irrigation of about

2000 ha lands. The idea of the reservoir has been submitted to the authorities, nevertheless, we would like you also to record this issue and submit it to the responsible agencies.

Answer

Asatur Yeritsyan The idea of the reservoir proposed by you is not an alternative to the Mastara reservoir, nevertheless we will record the raised issue and submit it to those responsible.

Statement

Argis Margaryan The right distribution of water is not provided by Talin WUA, as I suppose providing the irrigation of about 40-50 ha farmlands would not have to be a problem.

Question

Karine Movsisyan I wonder if the waters caught here do not affect the Aknalich basin.

Answer

Asatur Yeritsyan Though the river is in that catchment basin, it has the other feeding source, therefore there will be no impact on the Aknalich basin.

Question

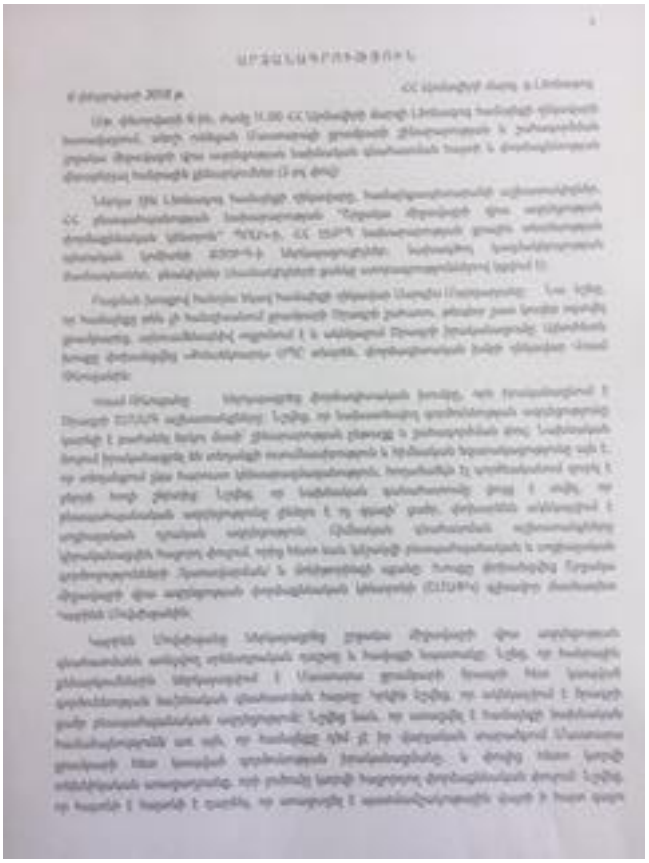
Karine Movsisyan How long will the Mastara reservoir construction take?

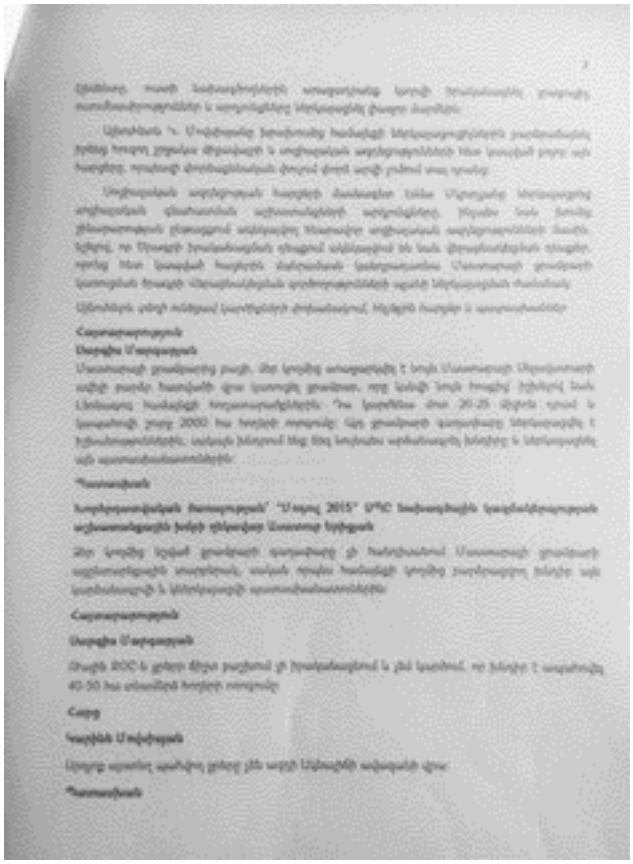
Answer

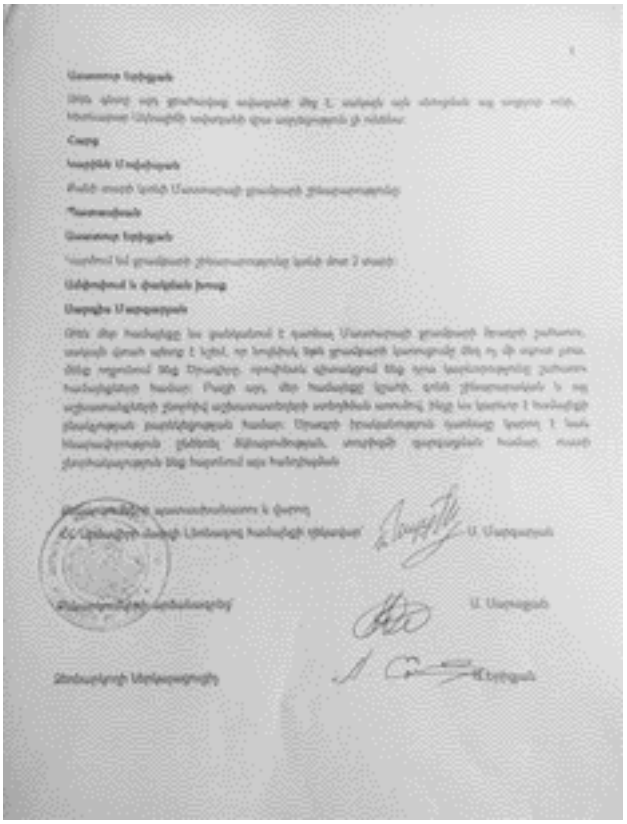
Asatur Petrosyan I think the Mastara reservoir construction will take about 2 years.

Wrap-up and closing remarks

Sargis Margaryan Though the community also wishes to become the Mastara reservoir Project beneficiary, it should be noted, that even if we do not benefit at all from the reservoir construction, we welcome the Project, as we understand its importance for the beneficiary communities. In addition, our community will at least benefit from the creation of jobs during the construction period and even after it, which is also important in terms of the welfare of the community population. The Project implementation may also provide the development of fishery and tourism. We would like to thank the PIU representatives and ESIA Team for this meeting and we are looking forward to implementation of this Project.







List of Participants

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ՑՈՒՑԱԿ

ՀՀ Արմավիրի մարզ, գ. Լեռնագոգ 6.02.2018

Անուն Ազգանուն	Կազմակերպություն կամ բնակության վայր	Կոնտակտային տվյալներ	Ստորագրություն
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MINUTES

of Third Public Consultations of Mastara Reservoir Construction Project

in Dalarik community of the RA Armavir Marz, on March 30, 2018

On March 30, 2018 at 11:00 at the premises of Dalarik Village Mayor, Public Consultations were held on Mastara Reservoir Construction and Operation Environmental Impact Initial Assessment Application and Expertise (3rd Stage).

Dalarik Community Mayor, the Community Administration staff members, representatives of the Water State Committee of Water Economy WSPIU of the RA Ministry of Energy Infrastructure and Natural Resources, representatives of Environmental and Social Impact Assessment Expert Team, specialists of Design Company and the community residents were present (List of Participants with signatures is attached).

Community Mayor Pargev Saghatelyan made an opening speech presenting the objective and participants of the Meeting. It has been noted, that it was the third time for the community to participate in public consultations of the Mastara Reservoir Construction Project Environmental and Social Impact Assessment, and, as it was already mentioned before, Dalarik community welcomes and is looking forward to the soonest implementation of the Project. Then, he passed the floor to the Consecoard LLC Director, ESIA Expert Team Leader Vram Tevosyan.

Vram Tevosyan presented the Expert Team, which is carrying out the Project ESIA works. He mentioned, that these public consultations were the third out of the four consultations mandatory for the initial assessment application stage. The main sections of the ESIA Report, survey results, description of the areas potentially related to the Project and the possible Project implementation impact on those areas were presented again. It has been outlined, that in frameworks of ESIA works, legal framework analyzes and baseline survey were carried out, and the potential impacts of the Project on land, flora and fauna were assessed, moreover, it has been assessed as low – minimal impact. At the same time, he informed that these impacts, their mitigation measures and agencies responsible for the implementation of mitigation measures are mentioned in the Environmental Management Plan annexed to the ESIA Report. In the framework of ESIA works, socio-economic impact assessment has also been carried out, and it will be presented in details by the WSPIU Social Specialist Marine Vardanyan.

Marine Vardanyan presented the necessity and importance of the social assessment in the frame of ESIA works, and briefly introduced the social impact assessment results. The potential social impacts during the construction stage with their mitigation measures were presented. The Project Grievance Redress Mechanisms were presented again, including the contacts of the PIU grievance responsible persons. Then she passed the floor to the Team Leader of Consulting Service - "Module 2015" LLC Design Company, Asatur Yeritsyan to present the details of preliminary design.

Asatur Yeritsyan presented the preliminary design of the reservoir. It has been mentioned that there are 2 design options, which mainly differ by the marks of dam's altitude, and the final option will be selected at a later stage.

Then there were exchange of opinions, questions and answers

Question

Pargev Saghatelyan What is the approximate size of the land to be used for the reservoir within Dalarik and Lernagog communities administrative areas?

Answer

Team Leader of Consulting Service - "Module 2015" LLC Design Company, Asatur Yeritsyan

The reservoir dam and basin will occupy about 64 ha area, of which about 60% is in the administrative area of Dalarik community.

Question

Slavik Poghosyan When will the construction of the reservoir commence?

Answer

Asatur Yeritsyan As soon as our works are completed, the relevant decision will be made, and the construction will commence only if its necessity is justified in the feasibility stage.

Wrap-up and closing remarks

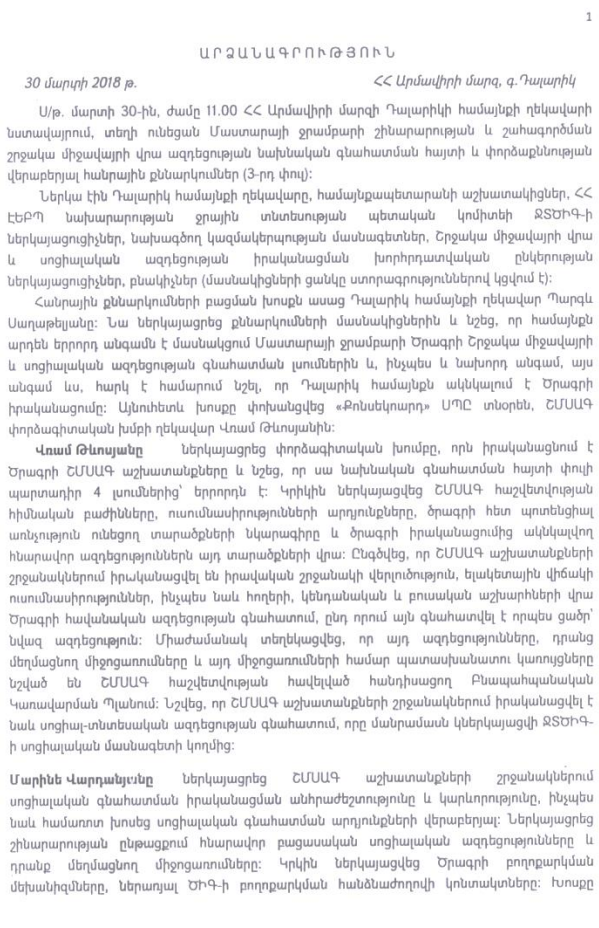
Pargev Saghatelyan Our community is looking forward to the implementation of this Project, as we see the potential for the development of fishery, tourism, improvement of climate, as well as believe that our community will also make use of the reservoir. We would like to thank the PIU representatives and ESIA Team and we are looking forward to soonest implementation of this Project, understanding the importance and urgency of the solution of reservoir beneficiary communities irrigation water supply issues. We express our willingness and readiness to support in the preparation and implementation of the Project.

Responsible and Moderator of Discussions

RA Armavir Marz Dalarik Village Mayor: P. Saghatelyan

Mintues taken by: E. Mkrtchyan

Initiator Representative: A. Yeritsyan



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ԱՐՁԱՆԱԳՐՈՒԹՅՈՒՆ

30 մարտի 2018 թ. *ՀՀ Արմավիրի մարզ, գ.Դալարիկ*

Ս/թ. մարտի 30-ին, ժամը 11.00 ՀՀ Արմավիրի մարզի Դալարիկի համայնքի ղեկավարի նստավայրում, տեղի ունեցան Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի և փորձաքննության վերաբերյալ հանրային քննարկումներ (3-րդ փուլ):

Ներկա էին Դալարիկ համայնքի ղեկավարը, համայնքապետարանի աշխատակիցներ, ՀՀ ԷԵՔՊ նախարարության ջրային տնտեսության պետական կոմիտեի ՋՏԾԻԳ-ի ներկայացուցիչներ, նախագծող կազմակերպության մասնագետներ, Շրջակա միջավայրի վրա և սոցիալական ազդեցության իրականացման խորհրդատվական ընկերության ներկայացուցիչներ, բնակիչներ (մասնակիցների ցանկը ստորագրություններով կցվում է):

Հանրային քննարկումների բացման խոսքն ասաց Դալարիկ համայնքի ղեկավար Պարգև Սաղաթելյանը: Նա ներկայացրեց քննարկումների մասնակիցներին և նշեց, որ համայնքն արդեն երրորդ անգամն է մասնակցում Մաստարայի ջրամբարի Ծրագրի Շրջակա միջավայրի և սոցիալական ազդեցության գնահատման լսումներին և, ինչպես և նախորդ անգամ, այս անգամ ևս, հարկ է համարում նշել, որ Դալարիկ համայնքն ակնկալում է Ծրագրի իրականացումը: Այնուհետև խոսքը փոխանցվեց «Քոնսենկոարդ» ՍՊԸ տնօրեն, ՇՄՍԱԳ փորձագիտական խմբի ղեկավար Վռամ Թևոսյանին:

Վռամ Թևոսյանը ներկայացրեց փորձագիտական խումբը, որն իրականացնում է Ծրագրի ՇՄՍԱԳ աշխատանքները և նշեց, որ սա նախնական գնահատման հայտի փուլի պարտադիր 4 լսումներից՝ երրորդն է: Կրկին ներկայացվեց ՇՄՍԱԳ հաշվետվության հիմնական բաժինները, ուսումնասիրությունների արդյունքները, ծրագրի հետ պոտենցիալ առնչություն ունեցող տարածքների նկարագիրը և ծրագրի իրականացումից ակնկալվող հնարավոր ազդեցություններն այդ տարածքների վրա: Ընգծվեց, որ ՇՄՍԱԳ աշխատանքների շրջանակներում իրականացվել են իրավական շրջանակի վերլուծություն, ելակետային վիճակի ուսումնասիրություններ, ինչպես նաև հողերի, կենդանական և բուսական աշխարհների վրա Ծրագրի հավանական ազդեցության գնահատում, ընդ որում այն գնահատվել է որպես ցածր՝ նվազ ազդեցություն: Միաժամանակ տեղեկացվեց, որ այդ ազդեցությունները, դրանց մեղմացնող միջոցառումները և այդ միջոցառումների համար պատասխանատու կառույցները նշված են ՇՄՍԱԳ հաշվետվության հավելված հանդիսացող Բնապահպանական Կառավարման Պլանում: Նշվեց, որ ՇՄՍԱԳ աշխատանքների շրջանակներում իրականացվել է նաև սոցիալ-տնտեսական ազդեցության գնահատում, որը մանրամասն կներկայացվի ՋՏԾԻԳ-ի սոցիալական մասնագետի կողմից:

Մարինե Վարդանյանը ներկայացրեց ՇՄՍԱԳ աշխատանքների շրջանակներում սոցիալական գնահատման իրականացման անհրաժեշտությունը և կարևորությունը, ինչպես նաև համառոտ խոսեց սոցիալական գնահատման արդյունքների վերաբերյալ: Ներկայացրեց շինարարության ընթացքում հնարավոր բացասական սոցիալական ազդեցությունները և դրանք մեղմացնող միջոցառումները: Կրկին ներկայացվեց Ծրագրի բողոքարկման մեխանիզմները, ներառյալ ԾԻԳ-ի բողոքարկման հանձնաժողովի կոնտակտները: Խոսքը

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փոխանցվեց Խորհրդատվական ծառայության՝ "Մոդուլ 2015" ՍՊԸ նախագծային կազմակերպության աշխատանքների ղեկավար Ասատուր Երիցյանին՝ նախագծի հետ կապված մանրամասները ներկայացնելու համար:

Ասատուր Երիցյան ներկայացրեց ջրամբարի կառուցման նախնական նախագիծը: Նշվեց, որ կա նախագծի 2 տարբերակ, ընդ որում հիմնական տարբերությունը ջրամբարի պատնեշի բարձրության նիշերի մեջ է, իսկ վերջնական տարբերակը կընտրվի ավելի ուշ փուլում:

Այնուհետև տեղի ունեցավ կարծիքների փոխանակում, հնչեցին հարցեր և պատասխաններ

Հարց

Պարգև Սաղաթելյան

Դալարիկ և Լեռնագոգ համայնքների վարչական տարածքում մոտավորապես որքան հող է օգտագործվելու ջրամաբարի շինարարության համար:

Պատասխան

Խորհրդատվական ծառայության՝ "Մոդուլ 2015" ՍՊԸ նախագծային կազմակերպության աշխատանքների ղեկավար Ասատուր Երիցյան

Ջրամբարի ընդհանուր պատվարը և հայելին կզբաղեցնեն մոտ 64 հա տարածք, որից շուրջ 60% գտնվում է Դալարիկի վարչական տարածքում:

Հարց

Սլավիկ Պողոսյան

Երբ կսկսվի ջրամբարի շինարարությունը:

Պատասխան

Ասատուր Երիցյան

Մեր աշխատանքները ավարտից հետո կկայացվի համապատասխան որոշում, ծրագրի արդյունավետության վերաբերյալ, և շինարարությունը կսկսվի այն դեպքում, երբ տեխնիկատնտեսական փուլում հիմնավորվի դրա անհրաժեշտությունը:

Ամփոփում և փակման խոսք

Պարգև Սաղաթելյան Մեր համայնքն անհամբեր սպասում է այս Ծրագրի իրականություն դառնալուն, քանի որ տեսնում ենք ձկնաբուծության, կլիմայի բարելավման և տուրիզմի զարգացման հնարավորություններ, ինչպես նաև վստահ ենք, որ մեր համայնքն էլ կօգտվի ջրամբարից: Շնորհակալություն ենք հայտնում ԾԻԳ-ի ներկայացուցիչներին և ՇՄՍԱԳ թիմին և ակնկալում Ծրագրի շուտափույթ իրականացում՝ խոստանալով ամեն կերպ աջակցել ձեր աշխատանքներում:

Քննարկումների պատասխանատու և վարող
ՀՀ Արմավիրի մարզի Դալարիկի համայնքի ղեկավար՝ Պ.Սաղաթելյան

Քննարկումների արձանագրեց՝ Է. Մկրտչյան

Ձեռնարկողի ներկայացուցիչ՝ Ա. Երիցյան

List of Participants

Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվության վերաբերյալ հանրային քննարկումների (3-րդ փուլ) նիստի մասնակիցների

ՑԱՆԿ

ՀՀ Արմավիրի մարզ, գ. Դալարիկ 30.03.2018

Անուն Ազգանուն	Կազմակերպություն կամ բնակության վայր	Կոնտակտային տվյալներ	Ստորագրություն
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[illegible]	[illegible]	098302545	
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[illegible]	[illegible]	077 99 99 51	
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[illegible]	[illegible]	099012030	

MINUTES

of Third Public Consultations of Mastara Reservoir Construction Project

in Lernagog community of the RA Armavir Marz,on March 30, 2018

On March 30, 2018 at 13:00 at the premises of Lernagog Village Mayor, Public Consultations were held on Mastara Reservoir Construction and Operation Environmental Impact Initial Assessment Application and Expertise (3rd Stage).

Lernagog Community Administration Secretary, the Community Administration staff members, representatives of the Water State Committee of Water Economy WSPIU of the RA Ministry of Energy Infrastructure and Natural Resources, representatives of Environmental and Social Impact Assessment Team, specialists of Design Company and the community residents were present (List of Participants with signatures is attached).

Community Administration Secretary Aleksandr Davtyan made an opening speech presenting the objective and participants of the Meeting. He noted, that these are the 3rd Environmental and Social Impact Assessment Public Consultations for Mastara Reservoir Project that the community participates in. Then, he passed the floor to the Consecoard LLC Director, Expert Team Leader Vram Tevosyan.

Vram Tevosyan presented the Expert Team, which is carrying out the Project ESIA works. He mentioned, that these public consultations were the third out of the four consultations mandatory for the initial assessment application stage. The main sections of the ESIA Report, survey results, description of the areas potentially related to the Project and the possible Project implementation impact on those areas were presented again. In frameworks of ESIA works, legal framework analyzes and baseline survey were carried out, and the potential impacts of the Project on land, flora and fauna were assessed, moreover, it has been assessed as low – minimal impact. At the same time, he informed that these impacts, their mitigation measures and agencies responsible for the implementation of mitigation measures are mentioned in the Environmental Management Plan annexed to ESIA Report. He noted that in the framework of ESIA works, socio-economic impact assessment has also been carried out, and it will be presented in details by the ESIA Expert Team Social Specialist Emma Mkrtchyan.

Emma Mkrtchyan underscored the necessity and importance of social assessment in the frame of ESIA works and presented the social impact assessment methodology and results. It's been mentioned the Project social impact is assessed to be positive, with the possibility of negative social impact only in construction stage, which were again presented in details along with their mitigation measures. The creation of temporary jobs during construction phase for community members, specifically with regard to unskilled labor works was specifically emphasized, mentioning that it was also the donor's requirement. Then the floor was passed to the Team Leader of Consulting Service - "Module 2015" LLC Design Company, Asatur Yeritsyan to present the details of preliminary design.

Asatur Yeritsyan presented the preliminary design of the reservoir. It has been mentioned that there are 2 design options, which mainly differ with the marks of dam's altitude, and the final option will be selected at a later stage.

Then there were exchange of opinions, questions and answers

Question

Aleksandr Davtyan Where the construction materials for the reservoir construction will be obtained?

Answer

Team Leader of Consulting Service - "Module 2015" LLC Design Company, Asatur Yeritsyan

The construction materials for the reservoir construction will be taken in the reservoir basin area, nevertheless, as those materials will not be sufficient for the reservoir construction, the additional material will also be procured.

Question

Aleksandr Davtyan As far as we know the main construction materials for the reservoir construction will be stone and basalt; we suppose, that instead of procuring those construction materials from other communities, moreover, from other marzes, their procurement from our communities should be considered. It will also be additional benefit for our community.

Answer

Team Leader of Consulting Service - "Module 2015" LLC Design Company, Asatur Yeritsyan

I do not think that those materials will be obtained from other communities or marzes if they may be procured from your communities. Nevertheless, to give a solution to this issue, it will be recorded and submitted it to those responsible.

Wrap-up and closing remarks

Aleksandr Davtyan Though the community is not the Mastara reservoir Project beneficiary, it will at least benefit from the creation of jobs during the construction period and if possible, from procuring construction materials from our community, which is also important in terms of the welfare of the community population. We would like to thank for this meeting and we are looking forward to implementation of this Project.

Responsible and Moderator of Discussions

RA Armavir Marz Lernagog Village Administraion Secretary:	A. Davtyan
Mintues taken by:	E. Mkrtchyan
Initiator Representative:	A. Yeritsyan

ԱՐՁԱՆԱԳՐՈՒԹՅՈՒՆ

30 մարտի 2018 թ. *ՀՀ Արմավիրի մարզ, գ.Լեռնագոգ*

Ս/թ. մարտի 30-ին, ժամը 13.00 ՀՀ Արմավիրի մարզի Լեռնագոգ համայնքի ղեկավարի նստավայրում, տեղի ունեցան Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության նախնական գնահատման հայտի և փորձաքննության վերաբերյալ հանրային քննարկումներ (3-րդ փուլ):

Ներկա էին Լեռնագոգ համայնքապետարանի աշխատակազմի քարտուղարը, համայնքապետարանի աշխատակիցներ, ՀՀ ԷԵԲՊ նախարարության ջրային տնտեսության պետական կոմիտեի ՋՏԾԻԳ-ի ներկայացուցիչներ, նախագծող կազմակերպության մասնագետներ, Շրջակա միջավայրի վրա և սոցիալական ազդեցության իրականացման խորհրդատվական ընկերության ներկայացուցիչներ, բնակիչներ (մասնակիցների ցանկը ստորագրություններով կցվում է):

Հանրային քննարկումների բացման խոսքն ասաց համայնքապետարանի աշխատակազմի քարտուղար Ալեքսանդր Դավթյանը: Նա ներկայացրեց քննարկումների մասնակիցներին և նշեց, որ համայնքը արդեն երրորդ անգամն է մասնակցում Մաստարայի ջրամբարի Շրջակա միջավայրի և սոցիալական ազդեցության գնահատման լսումներին: Այնուհետև խոսքը փոխանցվեց «Քոնսեկոարդ» ՍՊԸ տնօրեն, փորձագիտական խմբի ղեկավար Վռամ Թևոսյանին:

Վռամ Թևոսյանը ներկայացրեց փորձագիտական խումբը, որն իրականացնում է Ծրագրի ՇՄՍԱԳ աշխատանքները և նշեց, որ սա նախնական գնահատման հայտի փուլի պարտադիր 4 լսումներից՝ երրորդն է: Կրկին ներկայացվեց ՇՄՍԱԳ հաշվետվության հիմնական բաժինները, ուսումնասիրությունների արդյունքները, ծրագրի հետ պոտենցիալ առնչություն ունեցող տարածքների նկարագիրը և ծրագրի իրականացումից ակնկալվող հնարավոր ազդեցություններն այդ տարածքների վրա: Ընգծվեց, որ ՇՄՍԱԳ աշխատանքների շրջանակներում իրականացվել են իրավական շրջանակի վերլուծություն, ելակետային վիճակի ուսումնասիրություններ: Նշվեց, որ ընկերության կողմից իրականացված ուսումնասիրությունները ցույց տվեցին, որ տարածքը աչքի է ընկնում աղքատ կենսաբազմազանությամբ, հողածածկը գործնականում զուրկ է բերրի հողի շերտից: Ուսումնասիրության արդյունքների հիման վրա կատարվել է Ծրագրի հավանական ազդեցության գնահատում, ընդ որում այն գնահատվել է որպես ցածր՝ նվազ ազդեցություն: Միաժամանակ տեղեկացվեց, որ այդ ազդեցությունները, դրանց մեղմացնող միջոցառումները և այդ միջոցառումների համար պատասխանատու կառույցները նշված են ՇՄՍԱԳ հաշվետվության հավելված հանդիսացող Բնապահպանական Կառավարման Պլանում: Նշվեց, որ ՇՄՍԱԳ աշխատանքների շրջանակներում իրականացվել է նաև սոցիալ-տնտեսական ազդեցության գնահատում, որը մանրամասն կներկայացվի ՇՄՍԱԳ փորձագիտական խմբի սոցիալական մասնագետ Էմմա Մկրտչյանի կողմից:

Էմմա Մկրտչյան Ներկայացրեց ՇՄՍԱԳ աշխատանքների շրջանակներում սոցիալական գնահատման իրականացման անհրաժեշտությունը և կարևորությունը, համառոտ ներկայացրեց

սոցիալական ազդեցության գնահատման մեթոդաբանությունը և գնահատման արդյունքները: Նշվեց, որ ծրագրի սոցիալական ազդեցությունը գնահատվում է դրական, իսկ բացասական սոցիալական ազդեցություններ հնարավոր են միայն շինարարության ընթացքում, որոնք էլ կրկին ներկայացվեցին՝ դրանք մեղմացնող միջոցառումների հետ միասին: Հատկապես կարևորվեց շինարարության ընթացքում համայնքի բնակիչների համար հնարավոր ժամանակավոր աշխատատեղերի ստեղծման հարցը՝ որակավորում չպահանջող բանվորական աշխատանքների իրականացման առումով, ինչը նաև դոնորների պահանջ է: Այնուհետև, խոսքը փոխանցվեց Խորհրդատվական ծառայության՝ "Մոդուլ 2015" ՍՊԸ նախագծային կազմակերպության աշխատանքների ղեկավար Ասատուր Երիցյանին՝ նախագծի հետ կապված մանրամասները ներկայացնելու համար:

Ասատուր Երիցյան Ներկայացրեց ջրամբարի կառուցման նախնական նախագիծը: Նշվեց, որ կա նախագծի 2 տարբերակ, ընդ որում հիմնական տարբերությունը ջրամբարի պատնեշի բարձրության նիշերի մեջ է, իսկ վերջնական տարբերակը կընտրվի ավելի ուշ փուլում:

Այնուհետև տեղի ունեցավ կարծիքների փոխանակում, հնչեցին հարցեր և պատասխաններ

Հարց

Ալեքսանդր Դավթյան

Ջրամբարի շինարարության համար օգտագործվող նյութերը որտեղից են ձեռք բերվելու:

Պատասխան

Խորհրդատվական ծառայության՝ "Մոդուլ 2015" ՍՊԸ նախագծային կազմակերպության աշխատանքների ղեկավար Ասատուր Երիցյան

Ջրամբարի համար անհրաժեշտ նյութերը կվերցվեն ջրամբարի թասի տարածքից, սակայն քանի որ դա բավարար չի լինի շինարարության համար, բնականաբար լրացուցիչ շինանյութ ևս ձեռք կբերվի:

Հարց

Ալեքսանդր Դավթյան

Ջրամբարի շինարարության համար օգտագործվող հիմնական շինանյութը, ինչքանով գիտենք, լինելու է քարը և բազալտը, կարծում ենք, որ այլ համայնքներից կամ առավել ևս այլ մարզերից շինանյութը ձեռք բերելու փոխարեն պետք է դիտարկվի դրա ձեռքբերումը մեր համայնքներից: Դա կլինի լրացուցիչ օգուտ համայնքի համար:

Պատասխան

Խորհրդատվական ծառայության՝ "Մոդուլ 2015" ՍՊԸ նախագծային կազմակերպության աշխատանքների ղեկավար Ասատուր Երիցյան

Չեմ կարծում, որ այն դեպքում, երբ նշված շինանյութը հնարավոր լինի ձեռք բերել ազդակիր կամ շահառու համայնքներից, դրանք ձեռք բերվեն այլ տեղից: Իսկ հարցին լուծում տալու համար, ձեր առաջարկությունը կարծանագրվի և կներկայացվի համապատասխան մարմիններին:

Ամփոփում և փակման խոսք

Ալեքսանդր Դավթյան

Շահադիտանալով ջրամբարի շահառու, մեր համայնքը կշահի, գոնե շինարարական և այլ աշխատանքների շնորհիվ աշխատատեղերի ստեղծման, կամ հնարավորության դեպքում, համայնքից շինարարական նյութերի ձեռքբերման առումով, ինչը ևս կարևոր է համայնքի բնակչության բարեկեցության համար: Շնորհակալություն ենք հայտնում այս հանդիպման համար և ակնկալում Ծրագրի իրականացումը:

Քննարկումների պատասխանատու և վարող
ՀՀ Արմավիրի մարզի Լեռնագոգ համայնքի
աշխատակազմի քարտուղար՝ Ա. Դավթյան

Քննարկումների արձանագրեց՝ Է. Մկրտչյան

Ձեռնարկողի ներկայացուցիչ՝ Ա.Երիցյան

List of Participants

Մաստարայի ջրամբարի շինարարության և շահագործման շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվության վերաբերյալ հանրային քննարկումների (3-րդ փուլ) նիստի մասնակիցների

ՑԱՆԿ

ՀՀ Արմավիրի մարզ, գ. Լեռնագոգ 30.03.2018

Անուն Ազգանուն	Կազմակերպություն կամ բնակության վայր	Կոնտակտային տվյալներ	Ստորագրություն
[illegible]	[illegible]	055012030	
[illegible]	[illegible]	093-100-359	
[illegible]	[illegible]	09158663	
[illegible]	— " —	093727724	
[illegible]	[illegible]	094630-600	
[illegible]	[illegible]	093 29 61 08	
[illegible]	[illegible]	093 34 56 34	
[illegible]	[illegible]	094 283121	
[illegible]	[illegible]	09886513	
[illegible]	[illegible]	07776000	
[illegible]	[illegible]	077546687	
[illegible]	[illegible]	093845983	
[illegible]	[illegible]	093553028	
[illegible]	[illegible]	094 588830	

Photos