Water Sector Projects Implementation Unit

IRRIGATION SYSTEM ENHANCEMENT PROJECT

Kaghtsrashen Gravity Irrigation Scheme
Environmental and Social Impact Assessment

Originally approved March 2016
Amended March 2017
4.1.2. Physical Impact
4.1.3. Pesticides/Pest Management

4.2. Global and Regional Conventions

CHAPTER 5. BASELINE INFORMATION: BIOPHYSICAL ENVIRONMENT

5.1. Orography and Geomorphology
5.2. Structure of Earth Crust (Tectonics) and Earthquakes
5.3. Geological and Hydrogeological Conditions
5.4. Hydrology
5.5. Climate
5.6. Landscape and Soils
5.7. Flora and Fauna

CHAPTER 6. BASELINE INFORMATION: SOCIAL AND ECONOMIC CONDITIONS

6.1. Affected Communities
6.2. Current Land Use
6.3. Cultural Heritage

CHAPTER 7. DESCRIPTION OF KAGHTSRASHEN GRAVITY IRRIGATION SCHEME

7.1. Alternative Options
7.2. Description of Originally Planned Actions
7.3. Description of Kaghtsrashen Gravity Scheme As Per the Design Variation
7.4. Kaghtsrashen Gravity Irrigation Pipeline

CHAPTER 8. BENEFICIAL AND ADVERSE IMPACTS, AND MITIGATION AND ENHANCEMENT MEASURES

8.1. Design Phase
8.2. Construction Phase
8.2.1. Environmental and Social Impacts at the Construction Phase
8.2.2. Mitigation and Enhancement Measures at the Construction Phase
8.3. Operation Phase
8.3.1. Environmental and Social Impacts at the Operation Phase
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBRD</td>
<td>European Bank Reconstruction and Development</td>
</tr>
<tr>
<td>EDB</td>
<td>Eurasian Development Bank</td>
</tr>
<tr>
<td>EHS</td>
<td>Environmental Health and Safety</td>
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<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
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<td>EIAE</td>
<td>Environmental Impact Assessment and Expertise</td>
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<td>EMP</td>
<td>Environmental Management Plan</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
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<td>IDP</td>
<td>Irrigation Development Project</td>
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<tr>
<td>IFC</td>
<td>International Financial Corporation</td>
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<tr>
<td>ISEP</td>
<td>Irrigation System Enhancement Project</td>
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<tr>
<td>ISMP</td>
<td>Irrigation Systems Modernization Project</td>
</tr>
<tr>
<td>MA</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>MAC</td>
<td>Maximum Acceptable Concentration</td>
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<td>MNP</td>
<td>Ministry of Nature Protection</td>
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<td>MTA</td>
<td>Ministry of Territorial Administration</td>
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<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>O&amp;M</td>
<td>Operation and maintenance</td>
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<td>RA</td>
<td>Republic of Armenia</td>
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<td>RAP</td>
<td>Resettlement Action Plan</td>
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<td>RPF</td>
<td>Resettlement Policy Framework</td>
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<td>SCWS</td>
<td>State Committee of Water System</td>
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<td>WB</td>
<td>World Bank</td>
</tr>
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<td>WPIU</td>
<td>Water Project Implementation Unit</td>
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<tr>
<td>WUA</td>
<td>Water Users Association</td>
</tr>
</tbody>
</table>
Chapter 1. Executive Summary

1.1. Background for the Amendment of this ESIA Report

This document is an amended version of the ESIA Report for Kaghtsrashen Gravity Irrigation Scheme. The amendments were done due to the Gravity Scheme design variation aimed at meeting the concerns of Garni community as a result of which the previous headworks of the Gravity Scheme in Azat Gorge was removed for 5.2 km downstream the Azat River.

After the Design of Kaghtsrashen Gravity Irrigation Scheme was approved through all the procedures of the World Bank and Armenian legislation, the Tender for civil works of the Gravity Scheme was issued, the Contractors for three lots were selected and the civil works commenced in the spring, 2016. In parallel with the commencement of the civil works of Lot I (Lot I incorporates the construction of about 9 km pipeline in the gorge of Azat River and the headworks of the Gravity Scheme) some inhabitants of Garni community started to carry out protest actions against the Design reasoning the shortage of the required water quantity in the Azat River as well as the risks of possible adverse impact on the natural ecosystem of the gorge. The protests became more and more intensive, a number of other individuals and civil activists joined the protestors and demanded to cease the civil works and to bring the construction equipment out of the construction site. Although the environmental issues and risks raised by the complainers had already been observed at the design stage and all the mitigation measures were foreseen, as well as the availability of the required water quantity in Azat River was verified, the protestors refused to admit any professional explanation and justification and demanded to cease the civil works in the gorge of the River Azat and to review potential compromising design solutions.

People opposing the design even blocked the road of Yerevan-Garni-Geghard, which has touristic importance, for several times (on April 13 / May 21, 2016). On May 21, the 2016 RA Prime Minister personally visited Garni Community to give final solution to the problem and after getting familiarized with the situation he urged the protest organizers to cease the protest actions and assigned the entities responsible for the Project to suspend the construction works and find a feasible compromising option.

Pursuant to the assignment, the entities responsible for the Project implementation and the Design Company developed a package of design variations as a potential compromising option which aimed at removing the headworks of the gravity scheme for 5.2 km downstream the river. The hydraulic losses will be compensated by small pumps, which will pump the water up over the right slope of the gorge, and then the water will be conveyed to Arart Marz by gravity, as it was foreseen under the previous design. Moreover, in this case, large scale civil works or additional construction of facilities/buildings for the pumps will not be carried out, as it is designed to use the existing Hatsavan pump station and its infrastructure (the dam, desilting basin, feeding canal) constructed during the Soviet times.
1.2. Introduction

After independence, the economic structure of the Republic of Armenia (RA) has significantly changed. The previously industrial republic became an agrarian country. However, the agrarian economy faces significant challenges related to the lack of modern irrigation systems. The Government of RA is applying major efforts to solve this issue including both its own resources and those of the international organizations. With World Bank support the Government of RA implemented the Irrigation Development Project, and the Dam Safety Projects I and II. These projects undertook the most critical interventions helping to secure operation of 8 major irrigation systems. The interventions included rehabilitation of 260 km of the most deteriorated sections of main and secondary canals, 126 hydraulic structures (aqueducts and siphons), 310 km of drainage network, 11 pump stations, 238 deep wells, 74 reservoirs in dangerous condition, and tertiary canals servicing 26,000 ha. Another World Bank supported operation was the Irrigation Rehabilitation Emergency Project (IREP). It included rehabilitation of two primary canals of Talin and Armavir irrigation systems and improvement of water use efficiency in the two selected irrigation schemes. At present, the Government of Armenia is using World Bank funding for the implementation of Irrigation System Enhancement Project (ISEP) and is preparing a new Irrigation Systems Modernization Project. Physical investments under ISEP are intended for the conversion and reconstruction of several pumping schemes into gravity schemes and the rehabilitation of the priority canals. Reconstruction of Kaghtsrashen irrigation scheme is part of the ISEP investments.

The State Committee of Water Economy (SCWE) of the Ministry of Agriculture of the Republic of Armenia is the implementing agency of the World Bank supported irrigation projects, while the Water Sector Projects Implementation Unit (PIU) is responsible for their day-to-day management, monitoring and evaluation.

1.3. Kaghtsrashen Gravity Irrigation Scheme

Kaghtsrashen gravity irrigation scheme is located in the administrative territories of Kotyk and Ararat Marzes of the Republic of Armenia (RA). From a geographical point of view, the construction area belongs to Kotayk and Ararat valleys in the Southwestern part of the RA. Kotayk and Ararat valleys are among the main agricultural areas of the country.

Ararat Marz community lands are in extensive need of water while poor water supply hinders social-economic development of the communities. The project envisions the use of the Azat River water resources for irrigation of Ararat Marz communities through construction of Kaghtsrashen gravity irrigation scheme. The water intake will be in Kotayq Marz (From Azat River, below the Garni community) and it will be conveyed to Ararat Marz communities through the gravity scheme.

The Project mainly aims to save annually around 460 mln AMD (436 mln AMD of saved electricity costs and 24 mln AMD for pump operation and maintenance costs), through transferring from mechanical to gravity irrigation water supply for the targeted 12 communities. This reduces the cost to farmers and community members of agriculture production. These savings in monetary terms are greater than the cost of the project.
Kagtsrashen Gravity Irrigation Scheme

Original scheme (before the Design Variation)

New scheme (according to the Design Variation)
Once constructed, Kaghtsrashen gravity irrigation scheme will serve 12 communities in Ararat Marz organized into the Artashat Water User Association (WUA). It will irrigate 378 ha of new lands (which were being irrigated before, but have dried out in the last few years due to absence of irrigation) in addition to 854 ha of existing irrigated lands with the same quantity of water due to increased irrigation water supply efficiency.

1.4. National Environmental and Social Regulations and WB Policies Applicable

In the Republic of Armenia, environmental issues are regulated according to several legislative acts, including the law on Environmental Impact Assessment and Expertise. This law governs the process of environmental screening, impact assessment, and permitting for various types of economic activities. According to the requirements of this law, construction of Kaghtsrashen irrigation system is Category C project (pipeline length is over 1km long and diameter is over 300mm) for which EIA is not required and only initial environmental screening is required. Thus, the positive conclusion of the initial environmental screening should be obtained prior to commencement of civil works.

ISEP triggers WB OP/BP 4.01 Environmental Assessment. Based on the nature and scope of physical activities required for the implementation of ISEP and reconstruction of Kaghtsrashen Gravity System, as well as the general types of impacts expected from such kind of construction, it is classified as environmental Category B and requires Environmental and Social Impact Assessment (ESIA).

ISEP 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. While there is no need for developing a Pest Management Plan, promotion of safe handling of pesticides and of the applicable techniques of the Integrated Pest Management is included into the project design.

ISEP will finance (Geghardalich Gravity Irrigation Scheme Project) heightening of a dam required for upgrading a reservoir feeding the scheme and, therefore, triggers OP/BP 4.37 Safety of Dams. As for Kaghtsrashen irrigation scheme, it does not include investment in raising or repairing a dam, and also there is no existing dam on which the scheme depends. Therefore, OP/BP 4.37 is not applicable to this particular investment.

OP/BP 4.12 Involuntary Resettlement is triggered, because construction of new irrigation pipelines, as well as rehabilitation of the existing ones - to lesser extent - may cause a need for temporary restriction of land use.

ISEP also triggers WB OP/BP 7.50 Projects on International Waterways. However the reason for that in investments into the Meghri scheme and OP/BP 7.50 is not applicable to works on Kaghtsrashen scheme.

1.5. Conceptual Alternatives

While preparing the concept for improved irrigation service delivery to the users of Kaghtsashen pumping scheme, the following design options had been considered:

- No project alternative, i.e. no intervention into Kaghtsrashen pumping scheme;
- Provision of irrigation water to Ararat Valley from water sources other than Azat reservoir, currently feeding the Kaghtsrashen pumping scheme;
- Construction of a new gravity pipeline and conversion of Kaghtsrashen pumping scheme into the gravity irrigation scheme.
Decision was made to select the third option, because:

- Presently Kaghtsrashen – 1 pumping station is fed from Artashat canal the main source of which is Azat reservoir. The operation of the pumping station consumes 10.0-11.0 mln kW/h energy without covering the entire demand of 12 communities;
- Using other water sources is problematic both from environmental and economic viewpoint, given that there is water resources shortage in the vicinity and bringing water from remote areas is very expensive and difficult for pipelines and canals construction;
- Converting from pumping to gravity would allow saving annually over 10 million kW/h energy consumed by pumping station.

1.6. Description of Originally Approved Design Works

The design envisages conversion of Kaghtsrashen irrigation scheme from pumping to gravity. Replacement of the mechanical irrigation scheme with a gravity scheme helps to save the pumping station operation and maintenance expenses, to reduce electricity consumption and to increase water conveyance efficiency.

The Consultant envisages having Kaghtsrashen head water intake structure on the mid-section of the River Azat in Kotayk Marz at the altitude of 1,235.5m, below Garni community.

Kaghtsrashen gravity irrigation scheme comprises of the water intake structure and derivation.

The head-water intake structure includes:

- Concrete weir with height of 2m;
- Water intake-washer;
- Mud collector combined with water intake;
- Fish pass;
- Pressure derivation.

The total length of the derivation pipeline is 27,579m. It will be implemented with steel pipeline with the diameter of 820-1,020mm. It is envisaged to lay a closed pipeline buried in the trench and will be routed through the gorge of the Azat River, along the right bank of Azat reservoir dam, then through the left bank of the river, continuing its route to 12 communities of Ararat Marz.

As a result of constructing headwater intake structure, with a concrete weir of 2m height, 1385.4 m² of territory will be potentially flooded, as shown in the map below.
1.7. Description of Design Variation

The Design Consultant has prepared the amended option of the design for the construction of the headworks and the pipeline of Kaghsrashen Gravity Irrigation Scheme (Lot 1 section), which includes DM52+56÷DM91+28.025. According to the previous design, it was foreseen to construct a head water intake and 9 km long metal pressure pipeline in the gorge of the Azat River.
In accordance with the Design Variation:

1. The water intake will be implemented near the main pipeline DM52+00 using the existing Hatsavan pump station;
2. The construction of the headworks (water intake) has dropped out of the design as well as the length of the pressure metal pipeline in Garni Gorge has been reduced with 5.2 km.
3. The design of the open section DM89+43÷DM90+16 of the pressure pipeline has been revised. The given section has been implemented on the steep slope through creation of a platform. The steel pipes of D=1000mm have been replaced with buried pipes of D=800 mm. The downstream 52 m long section of the pipeline with a=45° slope will be open on anchor supports.

The following activities have been implemented in the frames of the Design Variation:

- Hydraulic calculations to substantiate the dimensions of the head structure: weir, water intake, feeding canal, desilting basin, pipeline inlet and fish ladder;
- Complete hydraulic calculations for the water intake and pressure pipeline of the pump station.
- Calculation of pumps characteristics; selection of pump types, selection/justification of operational point of pumps for the selected pump to ensure the delivery of the design discharge.
- The architectural, constructive, mechanical, electrical parts of the pump house building has been developed. The energy supply will be implemented from Geghadir substation located in the area.
- The connecting point of the pressure pipeline of the pumping station with the main pipeline has been adjusted.
- Installation of ultrasonic flow meter has been envisaged upstream the pressure pipeline.

1.8. **Environmental and Social Impact Assessment Methodology**

As detailed further in Chapter 3, the ESIA process included the study of project documents and scientific literature, cadastral maps, as well as required field studies to verify the existing baseline data, to collect missing data, and to check the ownership of the used lands and to meet local stakeholders.

Biodiversity research was conducted over the territory of water intake and along its route. The research was conducted in spring 2014 and also in water scarcity conditions, in August 2014. The main objective of the research was to identify whether there are red-listed species in this area. The main objective of the research implemented in the area was to identify the endangered species, Red-listed species, the fruit trees which are privately owned and in future are subject to moving or cutting, green land of the working sites and parking spaces right in the working area. The research included study in the project area with participation of corresponding specialists in spring and autumn seasons. This study was done parallel to the design works and each one lasted for about a week, including walk over the irrigation scheme corridor and visual observation of the site to verify baseline information available from the literature and to reveal any additional aspects not noted in the publications. Further to that, in the autumn of 2014 and spring of 2015 additional walkovers were organized with participation of representatives of the local communities aimed at additional observations and clarification of some issues. The background information was compiled on the biophysical environment around the Project site, on the land tenure and land use along the route of the gravity system and its adjacent area, on the existence on the known or potentially present elements of historical and cultural heritage in the vicinity of the Project site. Appropriate photographic material was also collected.

The report identifies sensitive environmental and social receptors based on the baseline data and defines potential environmental and social impact at construction and operation stages. The envisioned expenses for the most important as well as several separate mitigation measures were calculated to be involved in the upcoming construction works.

The detailed Environmental Management Plan (EMP) has been developed as a result of classification of specific actions implying different environmental and social risks and implementation of envisioned activities.
to mitigate those risks. The indicators for qualitative and quantitative assessment of mitigation measures efficiency have been selected and used for development of environmental management structure.

1.9. Environmental and Social Baseline

The ecosystems of the project area are characterized with complex relief, ranging from semi-desert to alpine meadow landscapes. Semi-deserts, with their typical ecosystems, are distributed between the altitudes of 900m and 1250m. The Kaghtsrashen gravity irrigation scheme system is mainly located within this zone. Certain parts of the gravity system pass through dry steppe zone, which is more clearly reflected in the right section of the Azat reservoir. In this section ecosystems, characteristic to steppe and mountainous zones, are distributed. These ecosystems have been subject to anthropogenic influence for a long time. Particularly, in the territory of the head structure and downstream there are several small garden economies, as well as day-tour resort areas, which are quite popular in summer months. To serve the above-mentioned resort zones there is a community road, along which the Kaghtsrashen scheme pipeline will be laid down. Outside of the Azat canyon agro-ecosystems is widely distributed, which are being used by the location population, involved in farming and livestock breeding.

Garni community, within the administrative territory of which the head structure and part of the pipeline will be located, is well known for its historical-cultural and natural monuments, which have high touristic value. Particularly, 1,3 km upstream the head structure the Basalt Organ (usually referred to as “Symphony of Stones” by people) natural monument and 11th century medieval bridge are located. There are 3 other natural monuments about which corresponding information is provided in Section 8.3.1 of this ESIA Report. About 1.5 km upstream the head structure the only pagan temple in Armenia is located, built in the 1st century. Corresponding sections of this ESIA report provide detailed information on cultural values of the area.

The project area is located in the river Azat gorge, in Garni community neighborhood. The River Azat is formed from reconciliation of two rivers Goght and Milanda that start at Western slopes of Geghama mountain chain. Its source is located between three mountains - Azhdahak (2,080m), Pokr Aghdagh (3,447m) and Mets Aghdagh (3,560m).

In the West the Azat River basin neighbors with the River Hrazdan, in the North with Hrazdan’s brook Getar, in the East with Lake Sevan which is Geghama mountain chain with its basins and in the South the river Azat separates from the river Vedi basin with Geghama mountain derivations. At the upper stream the river basin is ruptured and it consists of rocks, mostly basalt.

The Azat River is the main irrigation source of the surrounding lands. The chemical composition of the water is based on physical-geographic conditions among which geological structure of the river basin has a special importance. Flowing through its bed from the source to the mouth the river collects natural, as well as anthropogenic pollutions, worsening its quality with its flow.

There are no residential houses in the territory of the canal, except for one in which two people live. There are a couple of cultivated lands, but they will not be affected by the construction, or the operation of the canal.

1.10. Expected Impacts and Their Mitigation

The main environmental and social risks related to the construction of Kaghtsrashen Gravity Irrigation System are as follows:

* Impacts of construction phase
  * Pollution of air during earthworks and handling works as well as during operation of engines of construction equipment;
  * Inconvenience caused to population in the neighborhood of the work sites caused by movement of vehicles and machinery in construction phase;
• Inconvenience caused to population in the neighborhood of the work sites to access their lands and/or potential impacts on livelihoods;
• Potential distrust/lack of support by communities for the scheme based on fear for some social and environmental issues, lack of irrigation water during conversion of the scheme from pumping to gravity;
• Temporary and/or permanent use/acquisition of community land;
• Traffic disturbance caused by construction vehicles and machinery;
• Soil degradation and erosion caused by damaged vegetation;
• Soil and water resources pollution caused by spillage in construction phase;
• Soil pollution by construction and household wastes in construction phase;
• Damage to workers’ health resulting from the use of poor quality and irrelevant construction materials in construction phase.

To mitigate the impacts the following is required:
• Ensuring functional operation of construction machinery and equipment without failure;
• Arranging fueling, ablution and other services for construction machinery and equipment in service centers or those areas of the construction site which exclude transportation of oils, fuel and lubricants into natural water basins;
• Operating construction machinery and equipment during working hours and switching the engines off in non-working hours;
• Providing the movement of transportation and equipment by existing or designated roads to avoid damage to vegetation;
• Keeping the sub-soil and top-soil separately and using top-soil to cover and reinstate the construction site;
• Stockpiling construction materials and wastes in construction site and removing them regularly to the designated areas;
• Avoiding opening of new quarries to the possible extent and obtaining licenses for quarry operation if material sourcing is to be made by contractor. Alternatively, purchasing construction materials from licensed suppliers, given that the system for licensing quarries in Armenia provides sufficient environmental protection;
• Verifying that workers and all visitors are provided with individual protection means, are trained and have relevant permits;
• Conducting local consultations to ensure stakeholders’ perspectives are taken into account by the scheme design;
• Avoiding private land use in the detailed design as much as possible;
• Ensuring compliance with the Project RPF for any potential resettlement impacts implied by the detailed design;
• Obtaining required permissions/authorizations from land owners for any temporary land use which may be necessitated by design;
• Ensuring construction camps and storage are on communal or state lands (for which permission is obtained) and avoid private lands.

Impacts of the operation phase
• Decrease in residual flow during irrigation season;
• Pipe clogging and water leakage;
• Impacts from flooding of the head intake area;
• Impact of the head intake structure on the aesthetic value;
• Need for maintenance works on parts of irrigation system located on community/private lands;
• Positive impact of the Kaghtsrashen project on development of recreation and tourism, given that the small pond to be established will provide a location for swimming and leisure fishing.
Main measures for mitigation of operation phase impacts

- Overall, the project will not change the river flow regime in Azat River, given that after the project it will abstract the same amount of water 8.7 km upstream of the Reservoir, where it abstracts currently. As for the possible negative impact on the section between the water abstraction point and the Reservoir, more stringent control over intake for the irrigation purposes and compliance assurance with the minimum environmental flow by the State Environmental Inspectorate of the MNP will be undertaken. As the analysis in the section 8.3.1 shows, despite that fact that the annual environmental flow at the Kaghtsrashen System headwater structure is 26.81 mln m³, about 111.7 mln m³ will remain in the river after the project, which is much greater than the defined minimum environmental flow. Also, seasonal dynamics of the river flow will be kept. This will make sure that the aquatic fauna and flora and the ecology of the area are not subject to significant impact and continue their normal functioning after the project;
- Monitoring of pipelines’ operation and control of their passability;
- Flooding zone of the head structure is about 1,386 m². Mainly the territories of the right bank of the river will be flooded due to plain topography, whereas in the left bank of the river vertical cliffs are observed. The territories under the flooding zone on the right bank of the river are community lands with poor vegetation cover and fauna, and the flooding will not have significant impact on the relevant ecosystems;
- Ensure ongoing communications and information-sharing with local communities, including community authorities and private land owners;
- Communication and information-sharing with local communities, including community authorities and private land owners.

1.11. Environmental Management Plan

Present ESIA report includes an environmental and social management matrix, comprising of environmental and social management plan, and the monitoring plan. It covers both – construction and operation phases. SCWS, as the agency implementing the Project, has the overall responsibility for the management of impacts of Kaghtsrashen Gravity Irrigation Scheme construction. The Committee will carry out its functions through PIU. The PIU is authorized to carry out the supervision of the EMP implementation by the Construction Contractor and must report the results to the SCWE and the World Bank. It is expected that Kaghtsrashen gravity irrigation system will be commissioned by “Artashat” WUA, as the water supply of the lands of this system is provided by “Artashat” WUA. However, the final decision on this issue is under the jurisdiction of State Committee of Water Economy. The “Artashat” WUA will carry out management in operation phase. The State Environmental Inspectorate of the Ministry of Nature Protection (MNP) of the RA will supervise the compliance with environmental requirements in the operation phase.

1.12. Public Participation

Both the acting legislation of the RA (EIAEE Law) and the legal documents ratifying the policies of WB and other international organizations, require public outreach and consultations about the design, environmental and social impact assessment and decision-making phases.

Moreover, the RA ratified the Aarhus Convention, which determines all the necessary principles for public participation as follows:

1. Access to information: any citizen should have the right to get a wide and easy access to environmental information. Public authorities must provide all the information required and collect and disseminate them and in a timely and transparent manner;
2. Public participation in decision making: the public must be informed over all the relevant projects and it has to have the chance to participate during the decision-making and legislative process;

3. Access to justice: the public has the right to judicial or administrative recourse procedures in case a Party violates or fails to adhere to environmental law and the convention's principles.

In the early stage of the project and later, during the design stage of the project, several meetings were organized with the representatives and residents of the Garni community, during which the details of the Kaghstrashen gravity scheme project were discussed. When the project was ready, it was presented to the Head of Garni community and was placed on the official website of the WPIU. Afterwards, several public discussions were organized. All the minutes of the meetings are attached to this report (Appendix 2).
Chapter 2. Legal, Policy and Institutional Framework

2.1. National Legislation

Following the independence in 1991 the legislation of the Republic of Armenia (RA) was reviewed with the aim of developing a more comprehensive state policy towards ecological protection and sustainable use. Taking into account rapidly changing economic situation, the adopted laws have undergone many changes, and in some cases new laws are adopted.

2.1.1. 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.

2.1.2. Codes

Land Code (2001)

The Land Code defines the main directives for management use of the state lands, including those allocated for various purposes, such as agriculture, civil construction, industry and mining, energy production, transmission and communication lines, transport and other purposes. The Code defines the lands under the specially protected areas as well as other reserved lands. It also establishes the measures aimed to the lands protection, as well as the rights of state bodies, local authorities and citizens towards the land. Within the Kaghtsrashen project it is planned to include some lands for the pipeline, which should be done in accordance with the requirements of the Land Code.


The main purpose of the Water Code is to provide legal basis for protection of national water resources, 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 (2005) and National Water Program (2006), water cadaster and monitoring system, public access to 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.

2.1.3. Environmental Legislation

Law on Environmental Impact Assessment and Expertise (2014)

A new law on environmental impact assessment and expertise was adopted recently (July 2014). The Law provides legal basis undertaking state environmental expertise of planned activities and concepts and presents standard steps of EIA process. The Law establishes general legal, economic, and organizational principles for conducting mandatory State EIA of various types of projects and concepts of sectoral development.

According to this law, activities are classified into 3 categories: A, B, C.

The categories are defined on the basis of the volume of the activity, characteristics and the level of impact on environment. “A” category includes such large-scale processes which have a significant impact on the environment based on practice, particularly they are: the mining industry, chemical industries, hazardous waste transportation, recycling or landfilling, metals’, construction materials’ and other products’ high-output plants, thermal energy production large installations etc. "B" category includes practically the same types of activities, but on a smaller scale or productivity. “C” category includes the types of activities that
have a certain, not significant impact on environment but does not require assessment of this impact. Thus, water resources supply and water resources projects, envisaging having pipelines with diameter 300mm and more are classified as a “C” category for which EIA is not required and only initial environmental screening is required. For pipelines with a diameter less than 300mm no EIA and no initial environmental screening is required.

Kaghtsrashen Gravity Irrigation Scheme is classified as “C” category as an irrigation project, which has a pipeline with 300mm and more diameter and more than 1km length.

The state expertise procedure consists of 2 stages. During the first stage lasting 1 month, the Ministry of Nature Protection and the public are notified about the project (short summary), and the first round of public consultation it held. The Ministry of Nature Protection undertakes classification of a project and recommends TOR for the EIA, if the EIA is required according to the classification outcome. EIA is not required for “C” category, just a notification and public hearings of initial stage.

At the second stage, an EIA report is submitted to the Ministry of Nature Protection and the Ministry undertakes its review during 60 days for a category “A” project or 40 days for a category “B” project. Two public consultation meetings are required at this stage. The Ministry may extent the review deadline for up to 30 days after which it issues a positive (permitting) or a negative conclusion of the expert review.

Second stage of the state expertise will not be applicable to Kaghtsrashen Gravity Irrigation Scheme.

**Law on Flora (1999)**

The law defines the RA state policy in the field of maintenance, protection, usage and regeneration of flora. The law defines objectives for flora examination, state monitoring, state inventory, requirements and approaches to the preparation of the Red Book of plant species, conditions, peculiarities, limitations of allocation of flora objects for purposeful use, basis of termination of the right to use, provisions on flora maintenance, and economic encouragement of usage and implementation of supervision. Though in the territory of Kaghtsrashen Gravity Irrigation Scheme no red-listed plant species are found, some other plants can be damaged, so the requirements of this law should be taken into consideration.


The law defines the objectives of survey of the fauna, state monitoring, state inventory, requirements and approaches of red book preparation on fauna, conditions, peculiarities, limitations of allocation of fauna objects for purposeful usage, basis of termination of the right to use, provisions on fauna maintenance, and economic encouragement of usage and implementation of supervision. Though in the territory of Kaghtsrashen Gravity Irrigation Scheme no animal species registered in the Red Book are found, the construction works may change the living conditions of some of the animals, so the requirements of this low should be taken into consideration.

**Law on Wastes (2004)**

The law regulates legal and economic relations connected to collection, transfer, maintenance, development, reduction of volumes, prevention of negative impact on human health and environment. The law defines objects of waste usage, the main principles and directions of the state policy, the principles of the state standardization, inventory, and introduction of statistical data, the implementation of their requirements and mechanisms, the principles of wastes processing, the requirements for presenting wastes for the state monitoring, activities to decrease the amount of the wastes, including nature utilization payments, as well as the compensation for the damages caused to the human health and environment by the legal entities and individuals, using the wastes, as well as requirements for the state monitoring and legal violations. Since the construction works will create construction waste, its final deployment and storage should be carried out according to the requirements of this law.

**Law on Environmental Oversight (2005)**
This Law regulates issues of organization and enforcement of oversight over implementation of environmental legislation of the Republic of Armenia, and defines the legal and economic bases underlying the peculiarities of oversight, the relevant procedures, conditions and relations, as well as environmental oversight in the Republic of Armenia. According to this law, the environmental legislation requirements applicable to the Kaghtsrashen Gravity Irrigation Scheme, shall be supervised by the State Environmental Inspectorate.

**Law on Specially Protected Natural Areas (2006)**

This Law defines legal basis and relations of the state policy for development, restoration, maintenance, reproduction and use of natural complex and separate objects, as well as ecosystems of specially protected natural areas of the Republic of Armenia. According to the law, specially protected natural areas are divided into four categories, National parks, State Reserves, Natural museums and the forth category is divided into three separate types: areas of international, national and local importance. “Khosrov Forest” State Reserve is located on the opposite side of Azat River, hence the project activities were designed taking into consideration the requirements of this law.

### 2.1.4. Water Resources

**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 provide for reliable irrigation water supply to members of the WUA, collect water payments and present and protect the rights of member water users. Within the objectives of the Association and Federation (Article 4) the following important issues from an environmental perspective could be mentioned: operation and maintenance of irrigation system; implementation of construction works and restoration of watercourses and irrigation systems; 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. The management of the irrigation system to be built within the Kaghtsrashen Gravity Irrigation Scheme project will be carried out by one of the WUAs.


The task of this law is to ensure the implementation of water supply and demand formation process, to set up priorities for use of water resources and to draw up water basin management plans. Given the overall objective to supply safe and reliable irrigation water to the target communities, Kaghtsrashen Gravity Irrigation Scheme project is directly related to the scope of this law.

**Law on the National Water Program (2006)**

The overall goal of the law is development of measures (short-, medium- and long-term) aimed at satisfying the needs of the population and economy, ensuring of ecological sustainability, formation and use of the strategic water reserve, and protection of the national water reserve. Given the overall objective to supply safe and reliable irrigation water to the target communities, Kaghtsrashen Gravity Irrigation Scheme project is directly related to the scope of this law.

### 2.1.5. Agricultural legislation

**Law on Amelioration of Agricultural Lands (2005)**

This law regulates relations related to amelioration of agricultural lands for the purpose of maintenance and increase of soil fertility, protection from erosion and salting and inclusion of less fertile soils in the agricultural circulation. Given the objective of the project to improve the irrigation system, it is closely related to preservation of agricultural land quality.

**Law on Phytosanitary (2006)**
The law regulates the relations between the state authorized agency and the physical and legal entities in the field of phytosanitary. It outlines the main issues in phytosanitary, procedures for the state registration of plant protection means, procedures for providing conclusions on the import of fertilizers, and defines the responsibilities in farming in terms of application of fertilizers. This law directly relates to the project, given the expected increase in the use of pesticide due to improvements envisaged by the project.

2.1.6. Social Legislation


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 ensure the rights of the disabled.


This code regulates collective and individual working relations, defines the bases for establishment, modification and termination of these relations and the order for their realizations, rights, obligations and responsibilities of subjects of the labor relations, as well as conditions for the providing of security and maintenance of the health of employees. During the construction works all labor relations must comply with the requirements of this law.


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. As part of the Kaghtsrashen scheme, contractors will promote gender-relevant temporary employment opportunities for both men and women in the affected communities. The available irrigation water under the gravity scheme will be equally distributed to men and women water users.

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

This Law provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations between protection and use activities. Article 15 of the Law describes procedures for, among other things, the discovery and state registration of monuments, the assessment of protection zones around them, and the creation of historic-cultural reserves. Article 22 requires the approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before the land can be allocated for construction, agricultural and other types of activities in areas containing monuments. Given that there are many historical and cultural sites not far from the Kaghtsrashen Gravity Irrigation Scheme project area, the requirements of the law are taken into account during the project design works.

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. Any land use required by the Project, whether temporary or permanent, must be implemented in accordance with this law.

2.2. Institutional Framework

The roles of the government agencies that will be involved primarily from an environmental perspective in the Kaghtsrashen Gravity Irrigation Scheme project are briefly presented below:
Ministry of Agriculture

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

The State Committee of Water Economy (SCWE) under the Ministry of Agriculture is the implementing agency for the ISEP. In 2014 the SCWE moved from the Ministry of Territorial Administration to the Ministry of Agriculture, but its functions largely remained unchanged. The Committee has a mandate of improving the management of companies engaged in water activities. Amongst other objectives, the SCWS promotes improvement of water services to the consumers and implementation of further reforms in the water infrastructure and service delivery. SCWS has the following functions: participates in the development and implementation of the National Water Policy and Water National Program of the RA; submits to the RA Government annual reports on water utilization by a breakdown of sources and user companies; executes authorized management of state stocks 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.

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. The MNP implements those functions through the following structural departments:

- Normative-methodological Department (including Division of Legislation and Division of Standards and Technical Regulations);
- Department of International Cooperation;
- Department of Environmental Protection (including Division of Biodiversity and Water Resources Protection and Division of Land and Atmosphere Protection);
- Department of Hazardous Substances and Waste Management;
- Department of Nature Protection and Environmental Economics;
- Department of Underground Resources Protection;
- Department of Meteorology and Monitoring of Atmosphere Pollution.

The MNP also undertakes several functions through the following bodies:

- Water Resources Management Agency with its six Basin Management Organizations is the key institution responsible for the water resources management including, but not limited to, the development and implementation of the National Water Policy, National Water Program and basin Management Plans; regulation of water use by issuance of permits for use of surface and ground water resources; assessment and classification of water resources by their use; participation in development of water standards and control of application, etc.;
- “State Environmental Expertise” SNCO conducts environmental assessments of designs for construction, reconstruction, rehabilitation and maintenance of water infrastructures according to the requirements of the Armenian legislation and ratified International Agreements and issues experts’ conclusions;
• State Environmental Inspectorate with its 11 regional offices oversees the implementation of legislative and regulatory standards in natural resources protection, use and renewal;

• Environmental Impact Monitoring Centre monitors surface water and air quality of Armenia through its network of observation points;

• Hydrogeological Monitoring Centre monitors groundwater quantity and quality through its network of observation points on the natural springs and on the drilled boreholes;

• Bio-resources Management Agency participates in the environmental impact assessment of designs for construction, reconstruction, rehabilitation and maintenance of water infrastructures. So do the Information Analytical Center and the Center for Waste Investigation SNCO.

The environmental assessment of the project, the issuance of water use permit and the control of the requirements of environmental legislation during the works should be carried out by different RA Ministry of Nature Protection Units.

**Ministry of Energy and Natural Resources**

The Ministry of Energy and Natural Resources is a republican body of 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 Resources and the Subsoil Concession Agency.

**Ministry of Territorial Administration and Emergency Situations**

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

The Ministry of Territorial Administration and Emergency Situations elaborates and implements the policies of the Republic of Armenia Government in the area of civil defense and protection of population in emergency situations. “Armenian State Hydro-meteorological and Monitoring Service” SNCO (Hydromet) 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.

The coordination and inter-municipal collaboration, as well as the control of possible accidents and emergency situations during the construction works will be carried out by the corresponding units of the Ministry.

**Ministry of Health**

Within the structure of the Ministry of Health the State Health Inspectorate 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.

**Ministry of Labor and Social Affairs**

Among other things the Ministry 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.
National Water Council
The National Water Council with its Dispute Resolution Commission is the highest advisory body within the water sector. It comprises representatives of major stakeholders from several ministries and is chaired by the Prime Minister. The role of the Council is the development of recommendations on the National Water Policy and Program and measures for implementation.

Public Services Regulatory Commission
The Public Services Regulatory Commission of the Republic of Armenia is responsible for establishment of tariff policy in water relations and issuing of permits for the use of water systems.

2.3. Licenses and Permits
Below are the licenses and permits to be obtained by the project client and contractor for the project implementation:

- Civil license in the area of capital construction, including development of design documents, engineering research and expertise to be held by a consulting company for the design of irrigation systems’ canals and pipelines.
- Civil license in the area of capital construction to be held by the construction company providing works.
- Positive conclusions for construction or rehabilitation of irrigation systems (for those cases when the irrigation systems pass through the borders of natural protected areas or buffer (protection) zones) issued by the RA Ministry of Nature Protection.
- Agreement from the relevant local/regional authorities (usually community leaders) for disposal of excavated materials and construction waste shall be obtained by the Construction Contractor prior to transportation and disposal of construction concrete rubbles, debris and spoils as well as excessive excavation materials. These agreements will make a possible for the construction companies to have small, temporary landfills, from where the construction waste will be transported to the centralized urban landfill. Thus, corresponding contracts will be signed with the communities, since in Armenia all lands (independent of their property type) are included within the administrative borders of the communities;
- In cases where the constructor supplies construction materials (earth, rocks, gravel and sand) directly from the mines, it is necessary to check the mining company’s license, given that the system for licensing quarries in Armenia provides sufficient environmental protection. In all cases, when the Water Sector PIU or the technical supervisor have doubts about the quality of the material used, the construction company shall conduct laboratory analysis to prove that the materials obtained are of satisfactory quality. This requirement is usually included in the construction contract.

2.4. Overview of the World Bank Operation Policies Triggered by the ISEP
ISEP triggers the following safeguard policies of the World Bank:

Table 1. Project steps in compliance with WB policy guidelines
### Title of a safeguard policy | Requirements of the policy in regard to works on Kaghtsrashen irrigation scheme
--- | ---
OP/BP 4.01 Environmental Assessment | According to the requirements of the WB Kaghtsrashen project has to undergo an environmental impact assessment and environmental monitoring should be performed during its implementation.

OP/BP 4.04 Natural Habitats | During the design phase of the project affected areas should be examined to determine the endangered natural habitats. A precautionary approach to natural resource management shall be applied to ensure opportunities for environmentally sustainable development.

OP 4.09. Pest Management | As a result of project implementation, it is expected to have improved and more reliable irrigation water supply, which implies a quantitative increase in the use of pesticides in the medium-term. This may have an additional negative impact on the environment, to reduce which corresponding regular trainings will be delivered by WUA’s on pest management practices.

OP/BP 4.11 Physical Cultural Resources | Use Chance Find Procedures, given that it is not expected that any physical-cultural resource will be affected.

OP/BP 4.12 Involuntary Resettlement | A Resettlement Policy Framework (RPF) has been prepared for this Project and will regulate all involuntary resettlement and land loss related with the project implementation including loss of land, temporary land use, loss of productive assets or access to such assets, and negative livelihood impacts.

OP/BP 4.36 Forests | Assist the protection of forests, which are located on the other bank of Azat River, through consideration of forest-related impact of all subproject operations, ensuring restrictions for operations affecting critical forest conservation areas.

OP/BP 7.50 Projects on International Waterways | OP/BP is triggered by ISEP, because it includes rehabilitation of other schemes too and one of those abstracts water from the tributary of trans-boundary river Araks. As for the Kaghtsrashen gravity irrigation scheme project, it does not trigger this safeguard policy, since there will be no change to the amount of water being taken from transboundary Azat River. Currently the irrigation water for the Kaghtsrashen system is abstracted from the Azat Reservoir, whereas after the project the same amount of water will be withdrawn 8.7 km upstream of the Reservoir.

### 2.5. Comparison and Identification of Differences between National Legislation and World Bank Policies

After independence, the newly adopted legislative acts were based mostly on the principles and rules inherited from the former USSR. They were predominantly oriented on the human health while ignoring nature conservation needs mostly being declarative in nature. Most of the methodological principles and standards developed during the former USSR were still in place.

Further amendments in legislation were based on international standards. The newly adopted Law on EIA and Expert Examination in line with the guiding principles of the Aarhus convention applies provisions for the
strategic environmental assessment and other elements of international and European regulations. It also requires environmental classification of activities into three categories depending on their risk.

At the same time there are certain discrepancies between the national legislation and the good international practice. In particular, according to the WB classification construction/reconstruction of the irrigation schemes would be classified into environmental Category A or B while according to newly adopted Law on EIAEE, such activities are not classified into any category. If the irrigation canals or pipes pass through the natural protected areas, forests and green zones then these projects are subject to examination as a “B” category, both during construction and reconstruction. Water resources supply and water resources projects, envisaging having pipelines with diameter 300mm and more are classified as a “C” category for which EIA is not required and only initial environmental screening is required. For pipelines with a diameter less than 300mm no EIA and no initial environmental screening is required. As for Kaghtsrashen project, it is planned to construct an irrigation pipeline with a diameter exceeding 300 mm (and over 1km in length), so this project is considered as "C" category, and is subject to initial environmental screening only (without EIA) according to the procedures of this category. In this respect there is a non-compliance between the RA and WB requirements of the legislation. According to the Republic of Armenia law "On the Environmental Impact Assessment and Expertise" the planned report for "C" category projects do not include extensive research and assessment. To overcome the above-mentioned discrepancy, PIU carried out full ESIA for the Kaghtsrashen Gravity Irrigation Scheme project as required by the World Bank policy and described its outcomes in the present report.
Chapter 3. Methodology

The present ESIA was carried out according to the Terms of Reference agreed with the World Bank and covered the entire scope of the Project, including construction and operation phases of the Kagtsrashen Gravity System.

The ESIA process included a desk study to review project documents and scientific literature, as well as fieldwork aimed at verification of the available baseline data, collection of missing information, checking the ownership of the lands to be used and meetings with the local stakeholders.

The main objective of the research implemented in the area was to identify the endangered species, Red-listed species, the defeasible fruit trees, green land of the working sites and parking spaces right in the working area. Thus, the botanist and the zoologist on the ESIA team walked over the irrigation scheme corridor and did visual observation of the site to verify baseline information available from the literature and to reveal any additional aspects not noted in the publications. To confirm identity of some plant species found in the project corridor, the ESIA team cooperated with the scientists of the Department of Plan Classification of the Institute of Botany under the National Academy of Science, and referred to the herbarium collection of this Department. The researches have been conducted in spring and also in water scarcity conditions, in August. The background information was compiled on the biophysical environment around the Project site, on the land tenure and land use along the route of the gravity system and its adjacent area, on the existence on the known or potentially present elements of historical and cultural heritage in the vicinity of the Project site. Appropriate photographic material was also collected.

Water balance in Azat River was calculated based on the historic and current data on monthly river flow, on the irrigation water demand by Kagtsrashen gravity scheme beneficiaries, and on the information available about other upstream and downstream water users.

One of the main criteria used for impact assessment on Azat River was the environmental flow (minimal flow to be left in the river bed after abstraction), which was determined as required by the national legislation and in accordance with the Decree of the Government of RA no. 927 dated 30.06.2011. According to this Decree, the environmental flow is defined as the average daily discharge of the 10 successive days with the lowest discharge. This 10-day period usually coincides with the period when there is no anthropogenic pressure on the river flow and conditions under which the aquatic life exists in the Armenian rivers. The analysis made in section 8.3.1 shows that downstream the water abstraction point for Kagtsrashen System for average years the environmental flow (minimal flow to be left in the river bed after abstraction) will be well maintained after the project. As for the unusually dry years, only in one month (August) there is a slight deficit of irrigation water supply. This means that while the proposed project will irrigate additional 378 ha of agricultural lands, 13% of the irrigation demand for August for these unusually dry years will not be met, but still the environmental flow will be maintained, as required by the law.

The socioeconomic data were gathered through desk studies, meetings and consultations at local municipalities and “Artashat” WUA, as well as through focus group discussions in the affected communities. The objective of these discussions and consultations was to reveal: the actual number of households in the communities; their opinion about the project and their interest in irrigation of new lands (which were previously being irrigated, but dried out in the last few years due to the absence of irrigation water); their attitude toward inconveniences during construction period; their concerns about the possible impacts of the project on their community, and about the community land use; concerns about the construction waste removal and other social and environmental issues.

Based on the collected, compiled and analyzed information, this ESIA report has identified sensitive environmental and social receptors based on the baseline data and defined potential environmental and social impact at construction and operation stages. The envisioned expenses for the most important, as well as several separate mitigation measures were calculated to be included in the upcoming construction works.
Finally, detailed Environmental Management Plan (EMP) has been developed as a result of classification of specific actions implying different environmental and social risks and implementation of envisioned activities to mitigate those risks. The indicators for qualitative and quantitative assessment of mitigation measures efficiency have been selected and used for development of environmental management structure.
Chapter 4. Technical and Environmental Standards and Regulations

4.1. Applicable National Standards

The quality of the environment in RA is regulated by the norms restricting the content (concentration) of certain substances in the environment, which are approved by the government decisions or by the order of the Head of Governmental body, responsible for the sector. These orders must be registered in the Ministry of Justice.

4.1.1. Environment

- Air quality is regulated only in the territories of settlements. The RA Government adopted Decree N 160, dated February 2, 2006, which defines is maximum acceptable concentrations (MAC) of four hundred substances for a single time and daily average exposure.

- The soil quality is regulated by the RA Health Minister’s N 01-N order as of January 25, 2010, on approving “Sanitary Rules and Norms of Soil Quality Hygiene Requirements N 2.1.7.003-10.”

- The surface waters’ quality is regulated by the RA Government Decree N75-N as of January 27, 2011 “On adopting the norms providing the water quality of each water basin management area, depending on the peculiarities of the area”. The decree defines 5 classes characterizing water indicators and the content of various substances for 14 major river basins, rivers and certain parts of the river, in the territory of the RA.

- Drinking water quality is regulated by the RA Health Minister’s N876 order as of December 25, 2008 on approving Quality control ”N2–III-A 2-1 sanitary rules and norms on “Hygiene requirements for the water quality of centralized water supply systems”.

4.1.2. Physical Impact

- The impact of noise in the territory of the RA is regulated by the RA Health Minister’s N 138 order as of March 6, 2002 on approving N2 – III – 11.3 sanitary norms on “Noise at Workplaces, Public and Residential Buildings, and Residential Construction Areas”.

- The impact of vibration in the territory of the RA is regulated by the RA Health Minister’s N 138 order as of March 6, 2002 on approving HN N 2.2.4–009–06 “Hygiene norms on Vibration at Workplaces, Public and Residential Buildings, and Residential Construction Areas”.

4.1.3. Pesticides/Pest Management

- The impact of the expected increase in the use of pesticides due to improvements envisaged by the project will be regulated by the Republic of Armenia law “On Phytosanitary”, adopted in 2006. The law outlines the main issues in phytosanitary, procedures for the state registration of plant protection means, procedures for providing conclusions on the import of fertilizers, and defines the responsibilities in farming in terms of application of fertilizers.


- On August 30, 2005 the Minister of Health of the Republic of Armenia issued a Decree No 790-N “On Approving the Sanitary Rules and Norms for Protection, Transportation, Application and Sale of
Pesticides”, which defines hygienic requirements for the protection, transportation, application and sale of pesticides in order to protect the health of the population, as well as outlines specific mechanisms for compliance assurance with these rules and norms.

4.2. Global and Regional Conventions

Armenia is a part of several international agreements including the Convention on Long-range Transboundary Air Pollution, the United Nations Framework Convention on Climate Change, Convention on Wetlands of International Importance especially as Water Habitat (Ramsar, 1971), Convention concerning the Protection of the World Cultural and Natural Heritage (Paris 1972), UN Convention on Biological Diversity (Rio-de-Janeiro, 1992), UNECE Convention on Environmental Impact Assessment in a Transboundary Context, UNECE Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), and etc.

Below are the conventions related to the project that are ratified by the RA.

Table 2. Participation of the RA in International Environmental Agreements

<table>
<thead>
<tr>
<th>N</th>
<th>Name, Place and Date</th>
<th>Ratified by NA RoA</th>
<th>In force for RA</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>GLOBAL CONVENTIONS</strong></td>
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<td>2</td>
<td>Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971)</td>
<td>Acceded as assignee by the request of MFA RA 1993</td>
<td>1993</td>
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<tr>
<td>3</td>
<td>Convention concerning the protection of the World Cultural and Natural Heritage (Paris 1972)</td>
<td>Acceded as assignee by the request of MFA RA in 1993</td>
<td>1993</td>
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<tr>
<td>4</td>
<td>UN Convention on Biological Diversity (Rio-de-Janeiro, 1992)</td>
<td>31.03.1993</td>
<td>14.05.1993</td>
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<tr>
<td>6</td>
<td>Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979)</td>
<td>27.10.2010</td>
<td>01.03.2011</td>
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<tr>
<td>10</td>
<td>UNECE Convention on access to information, public participation in decision making and access to justice in environmental matters (Aarhus, 1998)</td>
<td>14.05.2001</td>
<td>01.08.2001</td>
</tr>
<tr>
<td>N</td>
<td>Name, Place and Date</td>
<td>Ratified by NA RoA</td>
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<tr>
<td>11</td>
<td>UNECE Convention on Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992)</td>
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<td>12</td>
<td>Protocol on Water and Health (London, 1999)</td>
<td>In the process of ratification</td>
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<tr>
<td>13</td>
<td>European Landscape Convention (Florence, 2000)</td>
<td>23.03.2004</td>
<td>01.07.2004</td>
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<tr>
<td>14</td>
<td>Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979)</td>
<td>26.02.2008</td>
<td>01.08.2008</td>
</tr>
</tbody>
</table>
Chapter 5. Baseline Information: Biophysical Environment

The description of environmental elements (air, water, soil, biodiversity, etc.) presented below, are based on conducted studies, published research and materials and maps.

5.1. Orography and Geomorphology

From orographical point the region is typical highland with separated relief. Azat is a narrow and mountainous river in a deep valley.

From geological point the mountainous part of the basin consists of volcanic stones: basalts and andezit-bazalts. The left bank of the river Garni consists of multi-color mergels and conglomerates, while on the right bank at Kuru-Selaf basin there is a thin lava layer broken into separate pieces lying along south-western direction to the village Zovashen. The thickness of the layer at the village Goght is 2.5km, at Garni 1km and it ends at the village Zovashen. The lava layer consists of waterproof mergel and clay stones, while at Zovashen there are also foliated sandstones. The ground layer at the village is black soil of mountainous valleys, while below the village the soil is rich with clay sand.

The river has south-western stream and flows through a deep gorge to the village Zovashen. At this section the gorge has well-cultivated valleys at the slopes of 450 and above. At Garni village vicinity the right bank is very steep for about 4km with terraces of vineyards and fruit orchards. The left bank is steeper cut with small gorges. The right slope height is about 150m while at Zovashen it decreases to 50-60m. The left slope is 100m high at the beginning but it is mostly 60-70m.

The maximum river discharge is in spring and at the beginning of summer, whereas the minimum discharge is at the beginning of summer and in winter.

The absolute levels of the observed area vary from 1,235.54 to 1,120.0m.

5.2. Structure of Earth Crust (Tectonics) and Earthquakes

From seismic point the observed area is in grooved zone of Armenia and is included in Sevan-Shirak synclinorial zone according to its structure. The envisaged project area refers to Shirak syncline boarder. Here the Eocene volcanic rocks are grooved forming a number of anticline-syncline structures. These structures are intercrossed at some sections with different infringements.

According to “The seismic map of the RA territory” this area is in the third seismic zone with ≥9 seismic points.

5.3. Geological and Hydrogeological Conditions

From geological point the project area is at Transcaucasus area with Eocene volcanic rocks. There are rocks of various age and etymology in the area; Eocene volcanic rocks are widely spread in the form of tuffs, tuff-sand, basalt flows covered with diluvial-proluvial and alluvial deposits.

From tectonic point the area is in Shirak syncline boarder. Here the Eocene volcanic rocks are grooved forming a number of anticline-syncline structures. These structures are intercrossed at some sections with different infringements.

From hydrogeological point the rocks in the area as per their transparency can be divided into two main types. The first type is sand rocks and ground with big stones, which are described with light water penetration. The second type is cobble-pebble ground described with higher level of water penetration. The level of ground waters in this area depends on the Azat River level. As per their chemical composition these are freshwaters of hydrcarbonate-calcium and they are not aggressive toward concrete (W₄).
The contemporary physical-geological processes at the project area are expressed by hurricanes and gravitational movement of hurricane substances down the slopes as well as the river erosion and mudflows.

5.4. Hydrology

General Description of the Hydrology
The Azat River is formed from reconciliation of two rivers - Goght and Milanda, which flow from the western slopes of Geghama mountain chain. Its source is between three mountains - Azhdahak (2080m), Pokr Aghdagh (3447m) and Mets Aghdagh (3560m).

The Azat River is one of the left-side tributaries of the River Araks and it flows into Araks at 614km from the Araks River mouth. The river’s length is 65km and its watershed is 572km². The average height of the basin is 2132m, and the average slope is 55%.

In the West the Azat River basin neighbors with the River Hrazdan, in the North with Hrazdan’s tributary Getar, in the East with Lake Sevan, the watershed of which is Geghama mountain chain with its basins, and in the South the River Azat separates from the river Vedi basin with Geghama mountain derivations. At upper stream the river basin is ruptured and consists of rocks, mostly basalt.

From orographic viewpoint the region is a typical highland with separated relief. Azat is a narrow and deep mountainous river with V-shape cut and a valley.

“Armhydroenergyproject” institute has restored and developed the series of natural flows based on long-term actual measurements of the river discharges and water intake considerations. The data from the Hydrological Yearbooks of 1937-2012 were used for that purpose.

Table 3. Garni Meteorological Station

<table>
<thead>
<tr>
<th>No</th>
<th>Meteorological station</th>
<th>Altitude above the sea level, m</th>
<th>Observation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Garni</td>
<td>1422</td>
<td>Since 1930</td>
</tr>
</tbody>
</table>

Historical data of the following 4 tributaries of Azat River were also used, including historical data from hydrological observation post on Chorselav River (currently not operational) and fragmented data on Karmir, Goght and Miladara Rivers, obtained in different years through water intake organizations.

Table 4. Rivers Flowing into the Azat River

<table>
<thead>
<tr>
<th>No</th>
<th>River</th>
<th>Where it flows</th>
<th>Which bank it flows from</th>
<th>Distance from river mouth</th>
<th>Length of river</th>
<th>Water basin, km²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Karmir</td>
<td>Azat</td>
<td>right</td>
<td>40</td>
<td>21</td>
<td>56.0</td>
</tr>
<tr>
<td>2</td>
<td>Goght</td>
<td>Azat</td>
<td>right</td>
<td>32</td>
<td>16</td>
<td>122.0</td>
</tr>
<tr>
<td>3</td>
<td>Milidara</td>
<td>Azat</td>
<td>left</td>
<td>31</td>
<td>15</td>
<td>201.0</td>
</tr>
<tr>
<td>4</td>
<td>Chorselav</td>
<td>Azat</td>
<td>right</td>
<td>18</td>
<td>35</td>
<td>160.0</td>
</tr>
</tbody>
</table>

On Azat River itself the hydrological observations were conducted at two posts on rivers: Azat-Garni (see Annex 7 for the long term recorded data) and Landjazat (Zovashen) hydrological posts, and one hydrological post on Azat reservoir.

Table 5. Hydrological Posts on the Azat River

<table>
<thead>
<tr>
<th>River-observation post</th>
<th>Distance from river mouth, km</th>
<th>“0” mark, Baltic System, m</th>
<th>Water basin, km²</th>
<th>medium, high, m</th>
<th>Operation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azat-Garni</td>
<td>31.0</td>
<td>1215.04 BS</td>
<td>326</td>
<td>2420</td>
<td>1938 still operates</td>
</tr>
<tr>
<td>Azat-Lanjazat</td>
<td>15.0</td>
<td>945.64 BS</td>
<td>526</td>
<td>2220</td>
<td>1928 still operates</td>
</tr>
</tbody>
</table>
Table 6. Main Characteristics of Average Annual and Seasonal Discharge of Azat River

<table>
<thead>
<tr>
<th>River-Observation Station</th>
<th>Average annual discharge, m³/sec</th>
<th>Flow module, l/sec km²</th>
<th>Flow volume, mil. m³</th>
<th>Seasonal Distribution, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azat-Garni</td>
<td>4,94</td>
<td>15,15</td>
<td>155,86</td>
<td>52 31 17</td>
</tr>
<tr>
<td>Azat-Lanjazat</td>
<td>6,88</td>
<td>13,1</td>
<td>217,06</td>
<td>54 30 16</td>
</tr>
</tbody>
</table>

Figure 1. Hydrological Posts and Meteorological Stations

Tables below provide some hydrological characteristics of Azat River and its tributaries.

Table 7. Feeding Sources

<table>
<thead>
<tr>
<th>River-observation site</th>
<th>% during flood from general flow</th>
<th>Melting water and rainwater</th>
<th>Groundwater</th>
<th>% from annual flow</th>
<th>Melting water and rainwater</th>
<th>Groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azat-Garni</td>
<td>61</td>
<td>34</td>
<td>39</td>
<td>30</td>
<td>50</td>
<td>70</td>
</tr>
</tbody>
</table>

Table 8. Correlation of the river Azat feeding sources (% from total flow volume) during spring floods

<table>
<thead>
<tr>
<th>River-Station</th>
<th>Description of year</th>
<th>Year</th>
<th>Feeding Sources</th>
<th>Melting water</th>
<th>Rainwater</th>
<th>Ground flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azat-Garni</td>
<td>Average-water year</td>
<td>1956</td>
<td>34</td>
<td>50</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High-water year</td>
<td>1963</td>
<td>18</td>
<td>60</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low-water year</td>
<td>1961</td>
<td>60</td>
<td>24</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>
The annual distribution of water flow of the river Azat basin has seasonal nature. About 85% of annual flow happens during the months April-August. And as hydrograph, comparing the impact on Azat River flow downstream the Kaghstrashen Gravity Scheme intake before and after the project (section 8.3.1), shows the same seasonal dynamics of Azat River will be maintained after the project.

**Hydrological Calculations**

The actual measurements of Azat-Garni hydrological observation station of 1939-2014 were taken as the design baseline data. These actual data were converted to natural values taking into account the water use upstream the observation station with its irrecoverable losses (irrigation-85%, drinking-communal - 30%, fish farming - 10%). These natural series of average monthly flows were processed statistically according to the momentum method and maximum likelihood method. Based on the results, the theoretical average, maximum and minimum flow probability curves were plotted which well coincided with the observed flows. All the obtained values were recalculated into the average, maximum and minimum flows of various probabilities at the Azat River section based on the analogue method, which are presented in Tables 1, 2, 3.
Table 10. Annual Distribution of River Azat Average Discharge at the Kaghtsrashen gravity scheme intake point, m³/sec

<table>
<thead>
<tr>
<th>Probability, %</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>3.65</td>
<td>3.72</td>
<td>4.09</td>
<td>8.95</td>
<td>15.21</td>
<td>12.05</td>
<td>4.96</td>
<td>3.79</td>
<td>3.74</td>
<td>3.56</td>
<td>3.55</td>
<td>5.89</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>3.11</td>
<td>3.18</td>
<td>3.49</td>
<td>7.64</td>
<td>12.99</td>
<td>10.29</td>
<td>4.00</td>
<td>3.24</td>
<td>3.17</td>
<td>3.20</td>
<td>3.04</td>
<td>3.03</td>
<td>5.03</td>
</tr>
<tr>
<td>75</td>
<td>2.65</td>
<td>2.70</td>
<td>2.97</td>
<td>6.51</td>
<td>11.06</td>
<td>8.76</td>
<td>3.41</td>
<td>2.76</td>
<td>2.70</td>
<td>2.72</td>
<td>2.59</td>
<td>2.58</td>
<td>4.28</td>
</tr>
<tr>
<td>95</td>
<td>2.08</td>
<td>2.12</td>
<td>2.33</td>
<td>5.11</td>
<td>8.68</td>
<td>6.87</td>
<td>2.67</td>
<td>2.16</td>
<td>2.11</td>
<td>2.14</td>
<td>2.03</td>
<td>2.03</td>
<td>3.36</td>
</tr>
</tbody>
</table>

Table 11. Maximum Water Discharges in Azat River for Different Probabilities of Occurrence m³/sec

<table>
<thead>
<tr>
<th>River-Section</th>
<th>Q₀, m³/sec</th>
<th>Probability %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>Azat-Garni</td>
<td>31</td>
<td>140.0</td>
</tr>
<tr>
<td>Azat-Kaghtsrashen gravity scheme intake point</td>
<td>32</td>
<td>151.1</td>
</tr>
</tbody>
</table>

The minimum flow in Azat River is observed in winter, as well as in the low-water period of August-September.

Table 12. Minimum water discharges in Azat River for Different Probabilities of Occurrence, m³/sec

<table>
<thead>
<tr>
<th>River-Section</th>
<th>Q₀, m³/sec</th>
<th>Probability %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Azat-Garni</td>
<td>2.64</td>
<td>2.56</td>
</tr>
<tr>
<td>Azat - Azat-Kaghtsrashen gravity scheme intake point</td>
<td>3.60</td>
<td>2.65</td>
</tr>
</tbody>
</table>
The average 10-day minimum flow (environmental flow) observed at Azat-Garni station (in 1980) equals to 0.86 m³/sec. Applying the transition coefficient (K=1.037), it will be 0.88 m³ at the river section head intake which will be the value of the environmental flow at this section of Azat River.

Azat River is the main irrigation source of the surrounding lands. The water quality is good, clean transparent, and useful for both drinking and technical purposes. Some deterioration of quality occurs during spring floods due to the inflow of large amount of alluvium.

The water is soft at all seasons. The gas regime of the river is normal. The content of organic substances does not exceed the norms for household-communal water use.

Within the feasibility study, chemical composition of the river Azat water was analyzed in the village Garni. All parameters analyzed are in compliance with the requirements of the existing norms.

**Water Use in the Sub-Basin**

Maps below shows the water use in Azat River basin (section above the Azat reservoir) and route of the Kaghtsrashen gravity scheme pipeline.
Figure 2. Water Abstraction points in Azat River Sub-basin (above reservoir)
Figure 3. Route of the Kaghtsrashen gravity scheme pipeline
Water use for drinking-communal purposes
Upstream the head-structure, “Yerevan Djur” CJSC withdraws 49.2 mln m$^3$ of water for supplying drinking water to Yerevan city through Garni-Yerevan water supply pipeline system.

Water use for irrigation purposes
One of the major water users is Garni-Geghard” WUA which takes 11.5 mLm$^3$ water per year from Azat River through Garni main canal. It is expected that the water abstraction will be reduced down to 6 mil. m$^3$ under the rehabilitation project of the main canal and on-farm network of Garni community. Despite that, as per the water-economic calculation, the annual water demand is 11.5 mL/m$^3$.

Currently, 2.25 mil. m$^3$ water is accumulated per year in Geghardalich Reservoir from Karmir River for the irrigation purposes of Goght community. It will be 4.34 mil. m$^3$ in the frames of Geghardalich Gravity Irrigation Scheme Modernization Project.

A few hundred meters upstream of Kaghtsrashen gravity scheme water intake point there is another water user, a private entity, which withdraws 0.40 mln m$^3$ water per year, to irrigate 60 ha of agricultural lands. This water user does not have a valid water use permit at the moment but has been traditionally using water for irrigation of his agricultural lands. He used to have a proper permit, which has already expired. However, given that he has already applied for renewing his water use permit, this water withdrawal is also taken into account.

![Water intake structure for irrigating 60 ha of agricultural lands](image)

Downstream of the water intake point for Kaghtsrashen scheme and upstream of Azat Reservoir, “Garni-Geghard” WUA annually withdraws up to 0.21 mln m$^3$ of water, and pumps it to Hatsavan and Geghadir communities. Within another World Bank project it is envisaged to replace this pumping scheme with the Geghardalich Gravity Irrigation Scheme. Once the Geghardalich scheme starts its operation Hatsavan and Geghadir communities will receive gravity irrigation water from Geghardalich reservoir, thus, the pumping station will no longer take water from the Azat River. However, this water withdrawal is included in the overall water-economic balance, given that there might be some time gap after implementation of Kaghtsrashen gravity scheme project until the Geghardalich gravity project is completed.

There are also several very minor water uses for irrigation purposes downstream of the head structure which amount to 0.10 mln m$^3$ per year.

Water demand for Kaghtsrashen gravity scheme
Kaghtsrashen gravity scheme is planned for irrigating 1,232 ha of agricultural lands in 12 communities in Azat River basin: Narek, Kaghtsrashen, Getazat, Aygestan, Deghdzut, Norashen, Berdik, Nerqin Dvin, Hnaberd, Vardashen, Mrganush, and Verin Dvin, all of which are within the service area of “Artashat” WUA. This will replace current mechanical irrigation of 854 ha of agricultural lands and will include 378 ha of new agricultural lands due to increased irrigation efficiency. The total demand for Kaghtsrashen gravity scheme is 11.98 mln m$^3$, and the distribution throughout the year is presented below.
Table 1. Kaghtsrashen Gravity Scheme Demand

<table>
<thead>
<tr>
<th>Months</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual, mln m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaghtsrashen scheme demand</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.10</td>
<td>1.66</td>
<td>2.26</td>
<td>2.55</td>
<td>2.47</td>
<td>1.34</td>
<td>0.60</td>
<td>-</td>
<td>-</td>
<td>11.98</td>
</tr>
</tbody>
</table>

Proposed location of Kaghtsrashen gravity scheme intake point on Azat River

The head structure of the Kaghtsrashen gravity scheme is proposed to be located 1 km below the confluence point of Azat and Goght Rivers, in the gorge of the river Azat, 9 km above the Azat Reservoir. The head structure could not be located downstream, since in that case the pressure would not be enough for the gravity scheme. Also, the downstream of the proposed location the canyon gets narrower and is not convenient for head intake from structural perspective as well. As for the upstream of the proposed locations, the river gets larger and it is more difficult for captation of the water. Also, the altitude of the existing bridge and hydrological post do not allow for constructing head structure upstream of the proposed location, given inundation risk in the peak seasons.

Water-Economic Balance

For calculation of the water-economic balance in Azat River the following baseline information was used:

- Calculated flow at confluence of two rivers is 173.59 mln m³ for average year (50% probability of occurrence) and 152.46 mln m³ for low water year (75% probability of occurrence);
- Annual abstraction by “Yerevan Djur” company for drinking water supply is 49.2 mln m³;
- Water abstraction above the head structure for irrigating 60 ha of private agricultural lands composes 0.40 mln m³ for average year and 0.36 mln m³ for low water year;
- The environmental flow is calculated according to Government of Armenia Resolution No 927 (June 30, 2011) and composes 2.31 mln m³ per month (annually 27.77 mln m³). This flow is guaranteed even during drought years, and it represents conditions, under which the aquatic life exists in the Armenian Rivers;
- Water abstraction downstream the head structure for irrigating small plots of private agricultural lands composes 0.10 mln m³ for average years and 0.09 mln m³ for low flow years;
- Water withdrawal through Geghadir-Hatzavan pump station composes 0.21 mln m³ for average years and 0.19 mln m³ for low flow years;
- 11.5 ml/m³ water is taken per year from Azat River through Garni main canal.
- Currently, 2.25 mil. m³ water is accumulated in Geghardalich reservoir per year. It will be 4.34 mil. m³ after Geghardalich Gravity Irrigation Scheme Modernization Project. In water-economic balance the volume of Geghardalich was assumed 4.34 mil m³.
Kaghtsrashen gravity irrigation water scheme demand for average year is 11.98 mln m$^3$ and for low water year is 11.22 mln m$^3$.

As seen from the figures above, for low water years (75% probability of occurrence) irrigation water demand is reduced by 20%. Such norms are coming from Soviet times, when for low water or very low water years (Q75% and 95% respectively) irrigation water demand was reduced between 20-30%.

Thus, taking into account the above-mentioned approach, in the tables below the water economic balance of Azart River sub-basin is calculated for average water availability and low water years.
Table 14. Water-economic balance of Azat River sub-basin for 50% probability of occurrence, mil. m$^3$

<table>
<thead>
<tr>
<th>Month</th>
<th>Natural flow at the head structure, mil. m$^3$</th>
<th>Water demand of Garni main canal, mil. m$^3$</th>
<th>Geghardalich Reservoir, mil. m$^3$</th>
<th>Water intake of “Geghard–Hassavan”, pump station, mil. m$^3$</th>
<th>Other water users mil. m$^3$</th>
<th>Actual flow at Kaghtsrashen gravity scheme intake point, mil. m$^3$</th>
<th>Environmental flow, mil. m$^3$</th>
<th>Water available for use, mil. m$^3$</th>
<th>Kaghtsrashen scheme irrigation water demand, mil. m$^3$</th>
<th>Water deficit in the river, mil. m$^3$</th>
<th>Water remaining in the river, including the environmental flow, mil. m$^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.34</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>8.34</td>
<td>2.36</td>
<td>5.99</td>
<td>0.00</td>
<td>0.00</td>
<td>8.34</td>
</tr>
<tr>
<td>2</td>
<td>7.75</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>7.75</td>
<td>2.15</td>
<td>5.60</td>
<td>0.00</td>
<td>0.00</td>
<td>7.75</td>
</tr>
<tr>
<td>3</td>
<td>9.35</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>9.35</td>
<td>2.36</td>
<td>6.99</td>
<td>0.00</td>
<td>0.00</td>
<td>9.35</td>
</tr>
<tr>
<td>4</td>
<td>19.81</td>
<td>0.00</td>
<td>0.08</td>
<td>0.03</td>
<td>0.00</td>
<td>19.70</td>
<td>2.28</td>
<td>17.42</td>
<td>1.10</td>
<td>0.00</td>
<td>18.60</td>
</tr>
<tr>
<td>5</td>
<td>34.79</td>
<td>1.37</td>
<td>3.35</td>
<td>0.03</td>
<td>0.00</td>
<td>30.04</td>
<td>2.36</td>
<td>27.69</td>
<td>1.66</td>
<td>0.00</td>
<td>28.38</td>
</tr>
<tr>
<td>6</td>
<td>26.67</td>
<td>2.07</td>
<td>0.91</td>
<td>0.03</td>
<td>0.10</td>
<td>23.56</td>
<td>2.28</td>
<td>21.28</td>
<td>2.26</td>
<td>0.00</td>
<td>21.30</td>
</tr>
<tr>
<td>7</td>
<td>10.71</td>
<td>2.62</td>
<td>0.09</td>
<td>0.03</td>
<td>0.15</td>
<td>7.82</td>
<td>2.36</td>
<td>5.46</td>
<td>2.55</td>
<td>0.00</td>
<td>5.27</td>
</tr>
<tr>
<td>8</td>
<td>8.67</td>
<td>2.57</td>
<td>0.00</td>
<td>0.03</td>
<td>0.16</td>
<td>5.91</td>
<td>2.36</td>
<td>3.55</td>
<td>2.47</td>
<td>0.00</td>
<td>3.44</td>
</tr>
<tr>
<td>9</td>
<td>8.21</td>
<td>1.79</td>
<td>0.00</td>
<td>0.03</td>
<td>0.08</td>
<td>6.31</td>
<td>2.28</td>
<td>4.03</td>
<td>1.34</td>
<td>0.00</td>
<td>4.97</td>
</tr>
<tr>
<td>10</td>
<td>8.56</td>
<td>1.10</td>
<td>0.00</td>
<td>0.03</td>
<td>0.00</td>
<td>7.43</td>
<td>2.36</td>
<td>5.08</td>
<td>0.60</td>
<td>0.00</td>
<td>6.83</td>
</tr>
<tr>
<td>11</td>
<td>7.89</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>7.89</td>
<td>2.28</td>
<td>5.61</td>
<td>0.00</td>
<td>0.00</td>
<td>7.89</td>
</tr>
<tr>
<td>12</td>
<td>8.12</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>8.12</td>
<td>2.36</td>
<td>5.77</td>
<td>0.00</td>
<td>0.00</td>
<td>8.12</td>
</tr>
<tr>
<td>Total</td>
<td>158.89</td>
<td>11.52</td>
<td>4.43</td>
<td>0.21</td>
<td>0.49</td>
<td>142.23</td>
<td>27.77</td>
<td>114.46</td>
<td>11.98</td>
<td>0.00</td>
<td>130.25</td>
</tr>
</tbody>
</table>
Table 15. Water-economic balance of Azat River sub-basin for 75% probability of occurrence, mil. m³

<table>
<thead>
<tr>
<th>Month</th>
<th>Natural flow at the head intake, mil. m³</th>
<th>Water demand of Garni main canal, mil. m³</th>
<th>Water demand of Geghardalich Reservoir, mil. m³</th>
<th>Actual flow at Geghardavank pump station, mil. m³</th>
<th>Other water users, mil. m³</th>
<th>Water available for use, mil. m³</th>
<th>Water deficit in the river, mil. m³</th>
<th>Water remaining in the river, including the environmental flow, mil. m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.10</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>7.10</td>
<td>2.36</td>
<td>4.75</td>
</tr>
<tr>
<td>2</td>
<td>6.60</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>6.60</td>
<td>2.15</td>
<td>4.45</td>
</tr>
<tr>
<td>3</td>
<td>7.96</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>7.96</td>
<td>2.36</td>
<td>5.61</td>
</tr>
<tr>
<td>4</td>
<td>16.87</td>
<td>0.00</td>
<td>0.08</td>
<td>0.02</td>
<td>0.00</td>
<td>16.77</td>
<td>2.28</td>
<td>14.49</td>
</tr>
<tr>
<td>5</td>
<td>29.62</td>
<td>1.37</td>
<td>3.35</td>
<td>0.03</td>
<td>0.00</td>
<td>24.88</td>
<td>2.36</td>
<td>22.52</td>
</tr>
<tr>
<td>6</td>
<td>22.71</td>
<td>2.07</td>
<td>0.91</td>
<td>0.03</td>
<td>0.10</td>
<td>19.60</td>
<td>2.28</td>
<td>17.32</td>
</tr>
<tr>
<td>7</td>
<td>9.12</td>
<td>2.62</td>
<td>0.09</td>
<td>0.03</td>
<td>0.14</td>
<td>6.24</td>
<td>2.36</td>
<td>3.88</td>
</tr>
<tr>
<td>8</td>
<td>7.38</td>
<td>2.57</td>
<td>0.00</td>
<td>0.03</td>
<td>0.14</td>
<td>4.64</td>
<td>2.36</td>
<td>2.28</td>
</tr>
<tr>
<td>9</td>
<td>6.99</td>
<td>1.79</td>
<td>0.00</td>
<td>0.03</td>
<td>0.08</td>
<td>5.09</td>
<td>2.28</td>
<td>2.81</td>
</tr>
<tr>
<td>10</td>
<td>7.29</td>
<td>1.10</td>
<td>0.00</td>
<td>0.02</td>
<td>0.00</td>
<td>6.17</td>
<td>2.36</td>
<td>3.81</td>
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<tr>
<td>11</td>
<td>6.72</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>6.72</td>
<td>2.28</td>
<td>4.44</td>
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<tr>
<td>12</td>
<td>6.92</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>6.92</td>
<td>2.36</td>
<td>4.56</td>
</tr>
<tr>
<td>Total</td>
<td>135.30</td>
<td>11.52</td>
<td>4.43</td>
<td>0.19</td>
<td>0.46</td>
<td>118.70</td>
<td>27.77</td>
<td>90.92</td>
</tr>
</tbody>
</table>
5.5. Climate

The land shaft, geographic composition formed in mountainous continental conditions with meadow-steppe flora is conditioned by geological and geomorphologic complex structure.

The complexity of the topography and the mountain chain surrounding the basin have formed special climate conditions for different zones based on their absolute marks. The river flows through 2 different zones.

- Long hot summer
- Cold winter with humidity at all seasons.

<table>
<thead>
<tr>
<th>Garni Hydromet. Station</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
<th>Annual average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air temperature, °C</td>
<td>-5.0</td>
<td>-3.4</td>
<td>2.1</td>
<td>8.9</td>
<td>13.9</td>
<td>18.0</td>
<td>21.9</td>
<td>21.5</td>
<td>17.2</td>
<td>10.6</td>
<td>4.2</td>
<td>-2.2</td>
</tr>
<tr>
<td>Humidity (%)</td>
<td>75</td>
<td>72</td>
<td>67</td>
<td>61</td>
<td>56</td>
<td>53</td>
<td>52</td>
<td>55</td>
<td>61</td>
<td>71</td>
<td>76</td>
<td>63</td>
</tr>
<tr>
<td>Wind speed, m/sec.</td>
<td>1.2</td>
<td>1.3</td>
<td>1.3</td>
<td>1.6</td>
<td>1.5</td>
<td>1.5</td>
<td>1.4</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
<td>1.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Water stream(mb)</td>
<td>3.4</td>
<td>3.8</td>
<td>4.7</td>
<td>6.7</td>
<td>9.2</td>
<td>11.0</td>
<td>12.8</td>
<td>11.6</td>
<td>9.4</td>
<td>7.4</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Precipitation, mm</td>
<td>37</td>
<td>36</td>
<td>59</td>
<td>72</td>
<td>80</td>
<td>44</td>
<td>20</td>
<td>10</td>
<td>16</td>
<td>44</td>
<td>40</td>
<td>34</td>
</tr>
<tr>
<td>Under-saturation (mb)</td>
<td>1.4</td>
<td>2.0</td>
<td>3.2</td>
<td>6.4</td>
<td>9.4</td>
<td>14.2</td>
<td>19.3</td>
<td>20.0</td>
<td>15.3</td>
<td>8.1</td>
<td>3.6</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 14. Climate Conditions

<table>
<thead>
<tr>
<th>Station</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garni</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

The minimum temperature is observed in January-February and the monthly temperature is varies between (-2.2°C) - (-5.0°C), while in cold years the monthly temperature is varies between (-10°C) - (-15°C). On separate days the temperature may varies between (-21°C) - (-25°C). The highest temperature varies between 21.5°C – 21.9°C, on separate days it may rise to 30-35°C.

Frost appears in mid-December and remains till the beginning of February, afterwards the snow melts. The observations of many years show the frost remains for 30-45 days.

5.6. Landscape and Soils

From zoological-geographical viewpoint the area refers to Transcaucasian highland steppe region, Sevan sub-region.

There are different land shaft zones at different heights in the river Azat basin, where soils, flora and animal world are in close relation; steppe, forest and alpine land shaft zones come after each other from lowlands to highlands.

The observed area refers to semi desert and desert land shaft zones. The soil here is that of grey semi desert breakstone, carbonated at some places and very rocky.

The soil erosion is 25-70%; very rocky soils are 30-50%, deposit carbonated, the thickness of dark brown humus layer is 20cm.
5.7. Flora and Fauna

In the low mountainous and hill-wavy areas one can meet brown semi-desert, medley clay, gypsum-bearing, law salinity, light brown soils. They are formed in extremely dry, continental climate and semi-desert vegetation conditions, on sandy loam and loamy sand, which are rich with carbonates and road metals. Overall they are distinguished by the low potency of humus layer (1-2%). The vegetation on these soils is that of semi desert and desert. The vegetation is presented with oshindr-efemery together with Artemisia fragrans Wild., Kochia prostrata (L) Schrad., Capparis spinosa Willd, Ceratoides papposa Botsch.et Ikonn, Astraphaxis spinosa L., Rhamnus pallasii Fisch.et Mey., Tanacetum argyrophyllum (C.Koch) Tzvel., Poa bulbosa L. Bromus, Aegilops, Erémpyrum, Alyssum, Aeluropus litoralis (Gouan). It is also presented with halophil together with Salsola ericoides Bieb., S. Dendroides Pall., S. Nitraria Pall., Halocnenum strobilaceum (Pall ) Bieb. There are herbs in the river Azat basin – Grataegus atrosanguinea, Helichrysum armenium, Rubia tinctorum, Ononis arvensis, Capparis spinosa. There are also rare plants included in the Red Book in the region (outside of the project implementation area) - Triticum araraticum, Thesium szovitsii. In addition to he project implementation area, the project impacts and further risks were assessed also for the adjacent territories, which can be observed as potential project area of influence. Here the risks are very minor, given that along that project implementation area (pipeline route) there are agricultural lands, which serve as buffer zone between the project area of influence and Khosrov Forest State Reserve. On average the width of these agricultural lands composes 60-70 m, and they mitigate the impact of the project, serving as a buffer zone.

The project area is an active agricultural region. There are no endemic or rare, disappearing plants included in the Red Book in this area. The identification of the species was conducting during the spring and fall surveys (each of them lasted a week), as well as through comparison of the literature information and actual visualization observation results (see [1], [5], [9], [10], [11] for literature on flora species, and [2], [6], [16], [17], [21] for fauna species in Annex 8 – List of References).

The Transcaucasian highland steppe zone is divided into three sub-zones and sub-regions – Shirak, Lori and Sevan. The presented animal world is conditioned with the climate and vegetation typical to this area.

According to the study of research and respective literature there are 250 types of animal world representatives in the river Azat basin – 55 mammals: south-Caucasian grey bear, wild pig, hedgehog, mouflon, bezoarian goat, lynx, wolf, fox, leopard etc. there are 142 types of birds, 33 types of reptiles, 5 types of amphibious and fish, caterpillar, various butterflies, tarantula and several types of scarpions.

There are various fish kinds in the Azat River: such as Salmo trutta fario, Vimba vimba, Rutilus rutilus schelkovnikovi, Varicorhinus capoeta, etc. These fish species are not registered in the “Red Book of Plants and Animals of RA”.

There are 13 kinds of animals registered in the Red Book of Armenia although much more kinds of animals need protection.

The following rare kinds of animals from the Azat River basin and the vicinity are registered in the Red Book: Crocidura armenica Gureev, Testudo graeca L., Rhinolophus hipposideros Bechstein.

To maintain ecological balance of Azat River , the project defines the magnitude of environmental flow equal to 0.85m³/sec. The environmental flow is let out through fish pass ladder envisaged by the project ensuring free pass for ichtyofauna.

According to the spring and autumn research work in the field, conducting by the specialist of the ESIAI team, as well as study and comparison of literature materials with the additional visual observation “walk thoughts”, it can be concluded, that there are no rare, endemic kinds of animals in the project area. The animals observed in this area are spread inside and outside the river Azat basin.
Chapter 6. Baseline Information: Social and Economic Conditions

6.1. Affected Communities

Kaghtsrashen gravity scheme will provide irrigation water to Ararat Marz communities Aygestan, Berdik, Getazat, Deghdzut, Hnaberd, Mrganush, Narek, Nerkin Dvin, Norashen, Vardashe, Norin Dvin, and Kaghtsrashen, which are in agricultural-climatic zone of absolute irrigation. The main branch of industry in these communities is agriculture cultivating different kinds of fruits, vineyards, vegetables, etc. They grow tomato, beetroot, eggplant, watermelon, melon and wheat. They also breed cattle and keep bees. Some of the communities cultivate their spare lands as gardens, arable lands; the others use the spare lands as pastures. Rehabilitation of irrigation and drinking water pipelines and community roads are the key problems of these communities. Apart from agriculture food production is also developing in Mrganush and Norashen communities. There is a wine and brandy factory in Mrganush and wine factory in Norashen. Eighty percent of population in Verin Dvin are Assyrians. The table below shows number of population in the affected communities according to Census 2011.

Table 16. Population in Affected Communities

<table>
<thead>
<tr>
<th>Name of Administrative Entity</th>
<th>Actual Population</th>
<th>Permanent Population</th>
<th>Actual Number of Households** *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>Ararat Marz*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aygestan</td>
<td>2262</td>
<td>1099</td>
<td>1163</td>
</tr>
<tr>
<td>Berdik</td>
<td>734</td>
<td>351</td>
<td>383</td>
</tr>
<tr>
<td>Getazat</td>
<td>1833</td>
<td>922</td>
<td>911</td>
</tr>
<tr>
<td>Deghdzut</td>
<td>957</td>
<td>469</td>
<td>488</td>
</tr>
<tr>
<td>Hnaberd</td>
<td>589</td>
<td>288</td>
<td>301</td>
</tr>
<tr>
<td>Mrganush</td>
<td>1016</td>
<td>499</td>
<td>517</td>
</tr>
<tr>
<td>Narek</td>
<td>943</td>
<td>482</td>
<td>461</td>
</tr>
<tr>
<td>N.Dvin</td>
<td>2698</td>
<td>1313</td>
<td>1385</td>
</tr>
<tr>
<td>Norashen</td>
<td>2965</td>
<td>1431</td>
<td>1534</td>
</tr>
<tr>
<td>Vardashen</td>
<td>454</td>
<td>217</td>
<td>237</td>
</tr>
<tr>
<td>V.Dvin</td>
<td>1803</td>
<td>865</td>
<td>938</td>
</tr>
<tr>
<td>Kaghtsrashen</td>
<td>2698</td>
<td>1344</td>
<td>1354</td>
</tr>
<tr>
<td>Total</td>
<td>18952</td>
<td>9280</td>
<td>9672</td>
</tr>
<tr>
<td>Kotayk Marz**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garni</td>
<td>674</td>
<td>3367</td>
<td>3375</td>
</tr>
</tbody>
</table>

According to the results of surveys conducted by the RA National Statistic Service (NSS) on life standards of households, Ararat Marz is at middle levels with poverty rate (Table 12 shows poverty indicators of Ararat Marz).

**Table 17. Main Indicators of Poverty in Ararat Marz (%)**

<table>
<thead>
<tr>
<th>Marz</th>
<th>Extremely Poor</th>
<th>Poor</th>
<th>Percent in Poor</th>
<th>Percent in Total Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ararat</td>
<td>2.8</td>
<td>24.9</td>
<td>8.6</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Source: “Social Situation and Poverty in Armenia», 2009, p. 35

The poverty level in female and male headed households is slightly different countrywide (34.3% vs. 35.2% respectively in 2011). Female-headed families accounted for 24% of poor population as well as of entire population in 2011. Female-headed households with children under 6 are more vulnerable to poverty (3.6% higher risk).

According to the results of the research on households’ life standard conducted by the RA National Statistical Service, Ararat Marz has average poverty rate. The rate of poor population is 24.9%, which is higher than the average rate 23.5% for the country. The depth of poverty is 3.6% following the Lori Marz - 4.6%, Kotayq Marz 4.5% and Shirak Marz 4.2%, while the average rate for the country is 3.1%.

The table below shows the relation of different factors with vulnerability.

**Table18: Vulnerability factors in Ararat marz**

<table>
<thead>
<tr>
<th>Vulnerability Factors</th>
<th>National Human Development Survey % in households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large families</td>
<td>33.6</td>
</tr>
<tr>
<td>Families with many children</td>
<td>12.6</td>
</tr>
<tr>
<td>Female-headed families (migration of male population)</td>
<td>24.8</td>
</tr>
<tr>
<td>Families with disabled people and/or children</td>
<td>6.2 (in population)</td>
</tr>
<tr>
<td>Lonely elderly people</td>
<td>13.2</td>
</tr>
<tr>
<td>Unemployed population</td>
<td>53.9 of population above 16 is employed</td>
</tr>
<tr>
<td>National minorities</td>
<td>3.2</td>
</tr>
</tbody>
</table>


Although unemployed people are more vulnerable to poverty (44.1%), the poverty level varied among unemployed urban and rural population who are active from economic point-of-view. In terms of urban-rural differences of welfare, majority of the poor (64.3%) were urban residents.¹ This means that people engaged in agriculture in rural areas have increased opportunities to earn their living. The project will have positive impact on the living standards of the beneficiary communities providing them with stable gravity irrigation water to irrigate new lands and cultivate different crops.

**6.2. Current Land Use**

Agriculture is the highest in the rate of occupation in the RA Ararat Marz. The rural population accounts for 70.6% of the total population. More than half of economically active population is involved in agriculture - 65,289 people including 33,050 men and 32,239 women².

¹ Source: ILCS 2008-2010
² Active population of Ararat Marz (urban, rural) according to the type of their economic activity, gender and level of education, [http://armstat.am/file/doc/99481113.pdf](http://armstat.am/file/doc/99481113.pdf)
The main condition for having guaranteed high harvest in the Marz is the smooth operation of irrigation system. The indicators of agricultural harvest would be higher if new irrigation technologies such as drip irrigation, sprinkler, highly productive seeds, quality fertilizers and pesticides were used.

Despite the activities to improve the irrigation system in Ararat Marz there are still a lot of works left over.

The following activities are among the important works envisioned in the area of irrigation:

1) Operation, maintenance and inventory of present (operating) irrigation systems,

2) Final formation of WUAs, increased irrigation water supply through gravity schemes, reduced energy expenses, improved relations between water suppliers and users,

3) Construction of small reservoirs in communities, review of problems related to irrigation and development of a plan for problem solution.

The presently irrigated lands with cultivated crops in 12 communities of Ararat Marz together with new lands that will become arable due to Kaghtsrashen gravity irrigation scheme are presented in Table 18. The data are provided by “Artashat” WUA.

Table 19. Actual and new arable lands of affected communities

<table>
<thead>
<tr>
<th>#</th>
<th>Community</th>
<th>Total, ha$^3$</th>
<th>Lands</th>
<th>Total, ha$^3$</th>
<th>Vegetables</th>
<th>Vineyards</th>
<th>Fruit Gardens</th>
<th>Alfalfa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Narek</td>
<td>640.0</td>
<td>Actual lands, ha</td>
<td>627.0</td>
<td>89.0</td>
<td>179.0</td>
<td>349.0</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>13.0</td>
<td>0.0</td>
<td>5.2</td>
<td>7.8</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>Kaghtsrashen</td>
<td>110.0</td>
<td>Actual lands, ha</td>
<td>95.0</td>
<td>2.0</td>
<td>24.0</td>
<td>67.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>15.0</td>
<td>0.0</td>
<td>5.0</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>Getazat</td>
<td>50.0</td>
<td>Actual lands, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>50.0</td>
<td>0.0</td>
<td>20.0</td>
<td>30.0</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>Aygestan</td>
<td>50.0</td>
<td>Actual lands, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>50.0</td>
<td>0.0</td>
<td>20.0</td>
<td>30.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5</td>
<td>Deghdzut</td>
<td>20.0</td>
<td>Actual lands, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>20.0</td>
<td>0.0</td>
<td>8.0</td>
<td>12.0</td>
<td>0.0</td>
</tr>
<tr>
<td>6</td>
<td>Norashen</td>
<td>70.0</td>
<td>Actual lands, ha</td>
<td>27.0</td>
<td>0.0</td>
<td>5.0</td>
<td>22.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>43.0</td>
<td>0.0</td>
<td>15.0</td>
<td>28.0</td>
<td>0.0</td>
</tr>
<tr>
<td>7</td>
<td>Berdik</td>
<td>30.0</td>
<td>Actual lands, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>30.0</td>
<td>0.0</td>
<td>12.0</td>
<td>18.0</td>
<td>0.0</td>
</tr>
<tr>
<td>8</td>
<td>N. Dvin</td>
<td>86.0</td>
<td>Actual lands, ha</td>
<td>5.0</td>
<td>0.0</td>
<td>5.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>81.0</td>
<td>0.0</td>
<td>32.4</td>
<td>48.6</td>
<td>0.0</td>
</tr>
<tr>
<td>9</td>
<td>Hnaberd</td>
<td>28.0</td>
<td>Actual lands, ha</td>
<td>6.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>22.0</td>
<td>0.0</td>
<td>8.8</td>
<td>13.2</td>
<td>0.0</td>
</tr>
<tr>
<td>10</td>
<td>Vardashen</td>
<td>36.0</td>
<td>Actual lands. ha</td>
<td>36.0</td>
<td>3.0</td>
<td>1.0</td>
<td>31.0</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>11</td>
<td>Mrganush</td>
<td>58.0</td>
<td>Actual lands, ha</td>
<td>58.0</td>
<td>6.0</td>
<td>16.0</td>
<td>34.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>New land, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>12</td>
<td>V. Dvin</td>
<td>54.0</td>
<td>Actual lands, ha</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Garni is another affected community. The Kaghtsrashen Gravity Irrigation Scheme water intake head structure is located about 1 km downstream the reconciliation of the Rivers Azat and Goght and about 9km upstream Azat reservoir near Garni. According to the design the pipeline route passes along the community road or across community lands, but bypasses private lands in Garni gorge located on the left bank of the river along the road.

Presently the number of population in Garni is about 7995 and the number of households is 1910. The community has 600 ha of agricultural lands: 367 ha of ploughs, 51 ha of gardens, 12.5 ha of hayfields, 151 plots. The leading branches of agriculture are gardening and cattle breeding. All households are engaged in gardening. They mainly grow apples, apricots, and cherries. Tourism is developed in the community as there are many tourists visiting the 1st century A.D. pagan temple in Garni. The households also produce home-made canned fruits and dried fruits to sell to tourists.

6.3. Cultural Heritage

Garni settlement has an ancient history, and is best known for its Hellenistic temple.

Nearby (1.3km away from the water intake and the tube’s forepart) is a natural monument Basalt Organ with well-preserved basalt columns, carved out by the river. It is most easily reached via a road that leads left down the gorge just before reaching the temple of Garni. Another road leads to the gorge through the village, down a cobblestone road, and into the valley.

Once in the valley, turning right will lead to Garni Gorge, an 11th-century medieval bridge, and the Basalt Organ. Taking a left will lead along the river past a fish hatchery, up to the Khosrov State Reserve. Within the reserve is also Aghjots Vank of the 13th century, a church of Saint Stepanos and the fortress of Kakavaberd.

The aesthetic value of the territory will not be impacted due to implementation of the project, since the small pond to be established by the head intake structure will be far from the Basalt Organ” natural monument and the medieval bridge, which are located 1,3 km far from the head intake structure. Similarly, no impact on this area is expected during construction. Moreover, some positive impact of the Kaghtsrasen project on development of recreation and tourism is expected, given that the small pond to be established with the water intake structure will create favorable microclimate of the vicinity.
Chapter 7. Description of Kaghtsrashen Gravity Irrigation Scheme

7.1. Alternative Options

During the elaboration of the project design economic, financial and technical as well as environmental and social factors were considered.

Consequently the following options have been discussed during the project development:

- Without action/no changes,
- Agricultural lands irrigation in Ararat Valley from other sources,
- Construction of gravity irrigation scheme.

(a) Presently Kaghtsrashen – 1 pumping station is fed from Artashat canal the main source of which is Azat reservoir. The operation of the pumping station consumes 10.0 – 11.0 mln kW/h energy without covering the entire demand of 12 communities. The current project has been initiated based on this circumstance.

(b) The option of using other sources is problematic both from environmental and economic viewpoint; there is water resources shortage in the vicinity and bringing water from remote areas is very expensive and difficult for pipelines and canals construction.

(c) The proposed design will convert Kaghtsrashen irrigation scheme from pumping to gravity annually saving more than 10 million kW/h energy consumed by pumping station.

With the implementation of Kaghtsrashen gravity irrigation scheme project 12 communities served by Artashat WUA will be able to irrigate 378ha new lands (which were previously being irrigated, but dried out in the last few years due to the absence of irrigation water) in addition to actually irrigated 854ha lands with the same quantity of water, as a result of raising irrigation efficiency and elimination of pump stations with significant water losses. Based on these circumstances the option of gravity scheme was selected.

7.2. Description of Originally Planned Actions

Kaghtsrashen pumping station was launched in 1977. The pipeline has two derivations with 19,770m total length and 1,200l/s maximum outlet. The pumping height is 65-180m, depreciation is 50%. After dismantling it can be used for gravity scheme.

To convert Kaghtsrashen irrigation scheme from pumping to gravity the following structures will be built: head structure located on the river Azat in the South-East of Garni community and pressure pipeline with the length of 27,579m.

The head structure will be located 1 km downstream the reconciliation of the rivers Azat and Goght and about 8.8 km upstream of Azat reservoir in Azat Gorge.

The selection of the location is conditioned with site: the National Reserve Khosrov is on the left bank of the river, the ground road on the left, rather narrow gorge downstream and the existence of the bridge upper the point of the rivers confluence.

The head-water intake structure includes:

- Concrete weir with height of 2m,
- Water intake-washer,
- Mud collector combined with water intake,
- Fish pass/ladder,
- Pressure derivation.

The total length of the derivation pipeline is 27,579m. It will be implemented with steel pipeline with the diameter of 820-1,020mm. It will be closed pipeline buried in the trench and will be routed through the gorge of the river.
Azat, along the right bank of Azat reservoir dam, then through the left bank of the river it continues to 12 communities of Ararat Marz.

To provide a long use of the pipes, it is intended to use the protective paints that may contain harmful substances.

The head intake structure includes the following:

- Concrete water dam,
- Water intake-washer,
- Mud collector combined with water intake,
- Fish pass.

The fish pass consists of: main entrance, fish pass tract.

The length of the ladder fish pass is 20.0m.

The zoologist of the ESIA team has carefully studied the ecology of the fish species in Azat River. The fish pass with the above-mentioned technical specifications can ensure the migration and movement of the following fish types, which are distributed in Azat River: Salmo trutta fario, Vimba vimba, Rutilus rutilus schelkovnikovi, Varicorhinus capoeta, and etc.

The main entrance part has the length of 3.8m to pull fish to the fish pass; it has a form of an open gutter. The width of the water way is 1.5m, the length is 3.8m, and the depth is 0.8m. The ladder fish pass exit is Q=0.85 m$^3$/sec. The water way for the fish pass is from downstream to upper stream and vice versa for fish swim and pass. The basins’ fall is 0.4m. There are swimming holes with a basement of the following sizes - 0.7x 0.6 and a surface - 0.4x1.5m in the partition walls between the basins in chess-like arrangement. The walls and the basement have 0.4m of thickness and the partition walls between the basins have 0.2m thickness.

The scheme will be constructed with steel pipeline of 820, 1020mm diameters, buried in a closed trench. At first it will stretch along the right bank of the river Azat through the gorge for 9.1 km through the large slobs, stones, mainly of alluvium and colluvium origin, then it will go up the slope to the left side and runs through old alluvium basalts of quaternary age, which are covering the stratum of gypsiferous clay for 1.5 km, then the penstock will stretch along the right bank of Azat reservoir and weir for 3.7km on mezoic gypsiferous lime stones, then crossing the river bed in the downstream of the weir it will pass to the right bank and run through the limestones till the endpoint.

The digging of the trenches for the pipeline will be implemented without explosions, taking into account the characteristics of the soil surface layer.

7.3. Description of Kaghtsrashen Gravity Scheme as Per the Design Variation

The Gravity Scheme pipeline is a consecutive connection of pipes with various lengths and diameters (mainly $L= 800m, D= 1000mm$), with total length of 22 km. The pipeline intake will be located on the right side of the gorge of Azat River at 1110 m, the end point – at 1124.8m. The pipeline serves to transfer 230-980 l/sec of discharge per 10 days during the irrigation season.

The alignment of the pipeline goes through a mountain area with complex geological structure and topography. The upstream 4,084 m section of the pipeline (section AB) first goes along the right side of Azat River Gorge, then sharply goes up over the slope until the 1,170 m elevation of the plateau (“B” point). The next two sections of the pipe (BC and CD) are actually 3.5 km and 12.5 m long siphons with the bottom elevations of 1051 m and 975 m, respectively.

As the headworks of the pipeline is located at a lower level of the area than the end point, so water movement should be forced through pumps.

The headworks of the pipeline will be located at 1,110 m, at the river section of the intake constructed earlier. It is intended to use the intake, machine hall, settling basin with its flushing facilities of Hatsavan pump station which is taken out of operation. It was designed to dismantle this pump station as a result of the operation of
Geghardalich Gravity Irrigation Scheme, consequently the use of the pump station and its infrastructure for the operation of Kaghtsrashen Gravity Irrigation Scheme will not have any impact on other beneficiaries or water users.

In order to use the existing structures (the weir, feeding canal 1, feeding canal 2, settling basin with flashing halls, intake basin) as headworks of the pipeline, some rehabilitation works shall be implemented.

Since the water demand may differ up to four times by decades depending on irrigation season, it would be appropriate to choose 3 pumps: 2 pumps with 400 kw of power and 1 pump – 500 kw, two of which will work in parallel and the third one will be a standby pump. In case of the selection of above pumps, 2,000,000 kw/h of energy is annually required for pumping 12 M/m³ of flow.

The Infrastructure Existing at the New Head Intake Structure

**Weir.** The length of the top of the weir is 13.5 m, the height of the dam is 1.5 m. Currently on the top of the weir there is a depression with 0.5 m depth and 1 m width and the main part of the river flow goes through it (in August).

**The fish pass** is implemented in form of stepwise ladders and is located on the left side of the weir along the bank protection wall. It represents ten ladders with dimensions 1x1mx10cm to ensure migration of fish.

**The feeding canal 1** is located on the right side of weir. The canal has rectangular section with dimensions b=1.0 m; H=1.5 m; L=15.8 m and slope i₀=0.0024. The canal is equipped with required gates and have a possibility to regulate additional inflows.

**The feeding canal 2** is the continuation of feeding canal 1 and has the same dimensions and slope as feeding canal 1 and L=42.5m. The feeding canal of the operating pump station starts from the connecting unit of feeding canal 1 and feeding canal 2. Currently the presented canals are filled by sediments 1/3 of its height, as a result of which only 60 l/sec of discharge is provided by the canal 1, which is less than the design discharge.

**The desilting basin (not operating)** is double chamber with dimensions b=4,40m, L=16,0m and slope i₀=0.056, and it is equipped with required gates.

**Intake basin:** The bottom of the intake basin of pump station is at the level of the broad weir. It is not deep and is designed for the discharge of about 200 l/sec.

**Pressure distribution pipeline:** A rectangular trench with dimensions L=8,0m, width – 1,3m, and depth=1,6m, is located outside the longitudinal wall and a pressure distribution pipe is installed at the bottom of the trench. The suction pipes of pumps will start from this distribution pipe.
Actually, in accordance with the Design Variation of Kaghtsrashen Gravity Irrigation Scheme, the headwork structures located in the gorge of Azat River and of the pumping stations to be decommissioned due to the operation of Geghardalich Gravity Scheme will be used as headworks for Kaghtsrashen Gravity Irrigation Scheme through some modifications and rehabilitations. All the infrastructures required for the implementation of the Design Variation of Kaghtsrashen Scheme are available here. In order to use the above structures for Kaghtsrashen Scheme, it is necessary to increase their capacity so that the canal provides maximum 980l/sec of discharge required for the gravity scheme. The discharge will be increased only by making it deeper, excluding wall demolition and large scale civil works.

7.4. Kaghtsrashen Gravity Irrigation Pipeline

The initial length of 27,579 m gravity irrigation pipeline will be reduced by 5,256 m and will be 22,323 m. In accordance with the Design Variation the head structure will be located at DM 52+56 (0+00) and 22,323m pipeline will go up to the discharge basin DM275+79.89.

Table 20. The expected land use during the construction and operation of Kaghtsrashen Gravity Irrigation Scheme

<table>
<thead>
<tr>
<th>Level</th>
<th>Length m</th>
<th>Land use/ ha</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Permanent</td>
<td>Temporary</td>
</tr>
<tr>
<td>0+00÷52+56</td>
<td>- 5256</td>
<td>- 1.02</td>
<td>- 2.244</td>
</tr>
</tbody>
</table>
Kaghtsrashen Gravity Irrigation Scheme

<table>
<thead>
<tr>
<th>Level</th>
<th>Length m</th>
<th>Land use/ ha</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Permanent</td>
<td>Temporary</td>
</tr>
<tr>
<td>87+68÷101+13</td>
<td>1345</td>
<td>0.27</td>
<td>0.6</td>
</tr>
<tr>
<td>101+13÷145+15</td>
<td>4402</td>
<td>0.88</td>
<td>2.05</td>
</tr>
<tr>
<td>145+15÷152+87</td>
<td>772</td>
<td>0.15</td>
<td>0.3</td>
</tr>
<tr>
<td>152+87÷170+65</td>
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<td>0.35</td>
<td>0.7</td>
</tr>
<tr>
<td>170+65÷188+71</td>
<td>1806</td>
<td>0.36</td>
<td>0.84</td>
</tr>
<tr>
<td>188+71÷215+71</td>
<td>2700</td>
<td>0.53</td>
<td>1.3</td>
</tr>
<tr>
<td>215+71÷247+37</td>
<td>3166</td>
<td>0.63</td>
<td>1.5</td>
</tr>
<tr>
<td>247+37÷262+85</td>
<td>1548</td>
<td>0.31</td>
<td>0.73</td>
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<tr>
<td>262+85÷270+08</td>
<td>723</td>
<td>0.14</td>
<td>0.33</td>
</tr>
<tr>
<td>270+08÷275+79</td>
<td>571</td>
<td>0.11</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27579</strong></td>
<td><strong>5.45</strong></td>
<td><strong>12.36</strong></td>
</tr>
<tr>
<td><strong>According to the Design Variation total</strong></td>
<td><strong>22,323</strong></td>
<td><strong>4.43</strong></td>
<td><strong>10.116</strong></td>
</tr>
</tbody>
</table>

From PC87+68 the pipeline goes up the hill for the height of 1,345m then from PC101+13 it continues along the right bank of the reservoir for 4,402m to the dam. This land belongs to Landjazat community. Afterwards the pipeline passes through the territory of Azat Reservoir. Crossing the spillway, the River Azat and the fast stream at PC145+15 it passes through the reservoir land for 772m. There are young fruit trees in the reservoir territory, which might be damaged during the construction works. Thus, the trees will be replanted at a safer place before
the start of the works. “Azat Reservoir” is a state company, which has given its official agreement both for the land use and replanting of trees (Annex 3).

Crossing the River Azat the pipeline passes along the left bank of the river for 1,778m and along Dvin channel and communities (See please the Table 20) for 10,514m to the outlet basin. The pipeline reaching the outlet basin will provide 8 communities: Aygestan, Berdik, Gatazat, Deghdzut, Hnaberd, Nerkin Dvin, Norashen, and Verin Dvin, with irrigation water through derivations from the pipeline while 4 communities: Vardashen, Mrganush, Kagtsrashen and Narek, will be supplied by water from the basin.

Annex 6 presents the cadastral maps of land ownership, showing that the pipeline routing does not pass through private lands and passes only through community-owned and state-owned lands. In addition to the cadastral maps, in the course of the design works the representatives of the consultant company together with the PIU staff walked over the entire route of the pipeline to double check that the routing does not pass through any private land. Voluntary agreements from the 9 entities whose land will be crossed by the pipeline, namely YerevanDjur LLC, Azat Reservoir state company and the communities of Garni, Landjazat, Getazat, Verin Dvin, Nerkin Dvin, Norashen and Narek have been obtained and are included in Annex 3.


Chapter 8. Beneficial and Adverse Impacts, and Mitigation and Enhancement Measures

Replacement of the existing pumping station under the Kaghtsrashen gravity irrigation scheme will bring positive changes to delivery of irrigation water and water users will more easily obtain the required quantity of irrigation water in a timely manner. In addition, there will be significant cost savings from reduction in energy use, including ecological benefits through prevention of atmospheric pollution associated with energy consumption, including the benefit of climate change mitigation by elimination of energy use for pumps. The replacement of the undependable pumping stations by gravity system will increase the reliability of irrigation water resources, thereby increasing farmer incentives to cultivate high value crops.

In addition, the Kaghtsrashen gravity irrigation scheme will have positive social impact on agricultural development of the affected communities. The availability of quality irrigation water will contribute to agricultural and social-economic development of the target communities. Agriculture is the main source of income for most of the households especially women headed households and vulnerable groups who will be able to irrigate new lands, to cultivate more profitable crops and improve their livelihoods. It will slow down migration rates and will open perspectives for people who intended to leave their homelands for seasonal works or permanent living. They will have better opportunities for farming, agricultural production and trading. There will be more opportunities for vulnerable groups and youth to find seasonal employment as work-hands on private or leased farmlands.

The expected overall positive environmental and social impacts from the construction of Kaghtsrashen gravity irrigation scheme will be long-term and cumulative in nature, ultimately contributing to the increased social and economic benefits of the 12 communities affected.

The potential adverse environmental and social impacts for the construction and operation phases as well as for decommissioning of the Kaghtsrashen gravity irrigation scheme are described below.

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

8.1. Design Phase

Environmental and social mitigation requirements 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 final design documents include a list of approved borrow pits and agreed spoil disposal sites; agreements obtained from the relevant state and local authorities for use of water resources to feed the gravity system, borrow pits and sites for disposal of excavated spoils as appropriate; list of construction preparation temporary sites such as access roads, construction camps, transport and machinery sites, storage facilities, etc. With these preliminary agreements the communities have provided the main technical indicators (distance from the community, possible approximate locations and other items), which should be clarified during the actual construction work, in agreement with the communities.

The design documents provide technical solutions for minimizing impact on the water bodies (banks, bed, water flow and quality) not hindering water provision with relevant quantity and quality of different sections of the Azat River.

During the design of the pipeline route in project area a solution that excludes the earth works on cultivated lands was selected, while non-productive areas will be used for temporary storage of construction material and excavated soil.

8.2. Construction Phase

8.2.1. Environmental and Social Impacts at the Construction Phase

Environmental Impacts (assessed for original design)
During the construction phase some negative influences may be observed on the environment, such as surface and ground water pollution, degradation of lands and 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 site (const. camps, car parks, storages, etc.), operation of the mines, 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.

The expected possible environmental impacts expected during the construction are given below:

(a) Ambient Air Pollution

Emission of inorganic dust from excavation-loading works and emission of harmful substances and dust from combustion of diesel used by transportation means and machinery occur during the construction works. Welding works cause welding aerosol and manganese monoxide emissions. Concrete mixers work result in concrete dust emissions.

The main sources of emissions are below.

• Inorganic dust emissions at excavation-loading works;
• Dust emission during the vehicular traffic emission at construction machinery operating;
• Emissions at concrete mixture making works;
• Petrol fumes;
• Emissions at welding works.

The construction works will be carried out at rather far distance from the populated areas and harmful substances brought forth will not practically pollute the urban-industrial environment.

(b) Impact on Water Resources

Generally, in the construction phase the impacts on water resources may be expressed by implementation of direct construction works in the river bed, the construction materials stored in the construction site, hanged materials, items, oil-products, pollution of river water, construction effluents water, as well as generation of hard wastes in the result of workers’ activity during the construction phase. Hence pipeline laying will not require works within the water stream. Therefore in the result of implementation of construction the river water pollution is not expected.

(c) Earth works

Trench excavation works designed for Kagtsrashen gravity system may have temporary negative impact on the natural vegetation within the pipeline 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 and limited number of trees. Cutting of trees will be carried out occasionally in the right bank of Azat River near the Azat Reservoir. According to the botanical researches tree types of project areas are not included in RA Red Book of plants.

(d) Extraction of construction materials

Aggregates required for construction will be preferably obtained from 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.

(e) Generation of construction waste

Construction of the hydraulic structures and the pipeline will generate various types of waste, though not in vast amounts. Clearing of the pipeline corridor will require clearing of vegetation and will generate organic waste in the form of the removed grass, shrubs, and trees. Earth works will generate modest amount of excess material, because most of the excavated earth and topsoil will be used for backfilling. Other types of waste, typical for
general construction activities, are also expected in moderate amounts, including metallic and plastic construction waste, bad butches of concrete and asphalt, household waste from the work camp(s) or yards, as well as certain amount of hazardous waste such as operational spills of fuel and lubricants; and used oils, filters and tires from vehicles and machinery.

(f) Biodiversity

Data on biodiversity is provided in details above. According to analysis of data of existing literature and the results of the spring and fall field surveys, there are no flora and fauna species in the project area, recorded in the Red Data Book of Armenia (see [1], [5], [9], [10] and [11] for fauna related literature and [2], [6], [16], [17] and [21] for flora related literature in Annex 8 – List of References). Such species are observed only in the “Khosrov Forest” State Reserve, which are located on the left bank of Azat River (the pipeline will pass through the right bank). For these species special protection regime is defined. Noting that Khosrov Forest State Reserve is a specially protected area with high degree of biodiversity, it should be mentioned that the parts of the State Reserve which are located not too far from the project’s area of influence, is not distinguished with diversity of fauna species, and it is highly unlikely to meet fauna species there, including while migrating. This is due to the peculiarities of the terrain, as well as active economic activities in that part of the Garni gorge. Starting from the months of April-May up to the late fall (October-November) numerous tourists visit the area. Also local farmers are actively involved in economic activities, using transport and machinery for their crop production agriculture. Thus, this area is not considered to be even a migration route of the fauna and flora species observed in this region.

Since during the construction phase no significant alteration of the flow of Azat River is envisaged, and given that the main fish species in the project area are observed in Azat River, no significant impact is expected on them at this stage. In addition to that, in order to avoid any other potential negative impact, state environmental inspectoral control, control by the design company, and continuous control and monitoring by the PIU is envisaged throughout the entire construction phase.

During implementation of works, the noise generated by operation and movement of construction machinery will affect the livelihood of animals. It is supposed that in Khosrov Forest State Reserve some animal species during the nighttime perform some movement/migration within the territory of the reserve. They go down to Azat River to drink a water. The migration of these species to the right side of the river almost never happened because of the existence of small farms on the right bank of the river. Since the operation of construction equipment and construction works are not expected at night time, the noise of the construction techniques during the construction phase will be made only during the day and taking into account the distance between the habitats of state reserve’s animal species and the construction site, we can state, that the noise made during this phase cannot have a serious impact on the migration and natural development of the reserve’s animal species. At the same time, taking into consideration the width of the road, the existence of farmlands and temporary resort pavilions, one of the requirements to the construction company will be the use of relatively small machinery (instead of the classical large bulldozers and excavators smaller ones will be used), which will make it possible to avoid any exceedance of noise levels.

Dust emission during earthworks will have an adverse impact on vegetative layer.

During technical equipment operation fuel burning products will have adverse impacts on vegetation and animals.

As a result of disorganized storage and accidental leakage of used construction materials, fuel and lubricants the damage will be caused to vegetative top layer and animal habitats.

The main potential negative impact expected during the construction phase relates to plant species. Taking into consideration the equipment to be used and construction volumes, in certain areas partial tree cutting would be unavoidable. This judgment was proved during several site visits to the project area. According to the field observations, the negative impact is expected on Willow (Osier) (Latin: Salix) and Sweetbrier (Latin: Rosa) with their several sub-species. This species is widely distributed in this region (almost everywhere) and is not included in the Red Data Book of Flora of the Republic of Armenia. According to preliminary observations 5 Willow (Osier)
(Latin: *Salix*) trees and 7 Sweetbrier (Latin: *Rosa*) will be cut. This will neither destroy nor fragment the ecosystem. Also, instead of the cut trees the constructor is obliged to plant the same species at the ratio of 1:3.

**Environmental Impacts Expected from the Design Variation**

The impacts mentioned below are assessed only in comparison with the impacts expected from the previous design, as the general design impacts are already presented in the main ESIA report. The impacts presented below mainly refer to the construction stage, however they also refer to the operation stage, as according to the Design Variation the reduced 5.2 km long section will associate neither with construction nor operation stages.

**Water Resources.** The only aquatic ecosystem associated with the Scheme is Azat River. The Design Variation has positive impact compared with the previous design due to the following factors:

1. By removing the headworks for 5.2 km downstream, the impact from that 5.2km section on the gorge of Azat River which was expected from the water intake of the previous design is eliminated (though it was manageable and would have been implemented without violation of the environmental flow. Nevertheless it was a negative impact).
2. The additional water streams falling from the right slope of the gorge and approximately 200l/sec water that enters Garni community and returns to the river (as excess/unused water) and increase total amount of the river flow, additionally adding up to the environmental flow (in case of the Design Variation, it is not foreseen to take additional water quantities from the river for Kagtsrashen Scheme)
3. The use of Hatsavan pumping Station and its infrastructure will exclude the impact on water resources and hydro-biodiversity due to the construction works in the river bed, while in case of the previous design such impacts, although temporary, were expected.

**Soil Resources:** The Design Variation will have positive impact on soil resources compared with the previous design. According to design estimations, due to removing the headworks for 5.2 km downstream, it will be possible to reduce the soil surface permanently used for the scheme by 1.033 ha, and temporarily used lands - by 2.423 ha. Furthermore, the reduction of the pipeline by 5.2 km will enable to avoid excavation, movement and backfilling of 33,000m³ of soil, consequently to prevent the change of biotic components and structure of soil resources of the given area, as well as possible activation of erosion process in those areas.

**Flora and Fauna:** The decrease of the expected impact on soil and aquatic environment will also lead to positive impact on the biodiversity of 5.2km section of the gorge. Moreover, the species composition of the flora and fauna of the given area will be less affected due to the quantitative decrease of noise, vibration, emissions and operation of construction equipment, which is expected as a result of the Design Variation.

**PAs:** As it is already mentioned in different section of this report, "Khosrov Forest” State Reserve is located on the left side of Azat River, and 5.2 km reduction of the construction site previously designed in the neighborhood of the State Reserve is a positive fact and “0 action” will have positive impact especially on the animal species of “Khosrov Forest” State Reserve, on their development, reproduction, movement and natural migration.

Applying the same logic as in previous points, table 21 shows the decrease of dust, fuel and emissions expected from the 5.2 km-reduction of civil works and other works. Calculation basis/methods of reduced emissions are presented in Annex 8. Those decreases will directly have positive impact on the environmental components of the reduced section.
### Table 21. Quantities of reduced emissions due to the design variation

<table>
<thead>
<tr>
<th>N</th>
<th>Substance Name</th>
<th>Reduced quantity, t</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inorganic dust</td>
<td>6.83</td>
</tr>
<tr>
<td>2.</td>
<td>Carbon monoxide</td>
<td>0.36</td>
</tr>
<tr>
<td>3.</td>
<td>Saturated hydrocarbons</td>
<td>0.082</td>
</tr>
<tr>
<td>4.</td>
<td>Nitrogen dioxide</td>
<td>0.42</td>
</tr>
<tr>
<td>5.</td>
<td>Solid particles (carbon dust)</td>
<td>0.042</td>
</tr>
<tr>
<td>6.</td>
<td>Sulphur dioxide</td>
<td>0.039</td>
</tr>
<tr>
<td>7.</td>
<td>Welding aerosol</td>
<td>0.00454</td>
</tr>
<tr>
<td>8.</td>
<td>Manganese compounds</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>7.77814</td>
</tr>
</tbody>
</table>

**Impacts expected from the rehabilitation/operation of the pumping station**

According to the Design Variation, it is envisaged to use the existing building and infrastructure of Hatsavan pump station, which means that construction of a new building or use of new natural site is not foreseen. Only some interior rehabilitation works will be carried out in the building and the former pumps will be replaced with new ones. Three pumps are designed to operate: 2 pumps with 400 kw of power and 1 pump – 500 kw, two of which will work in parallel and the third one will be a standby pump. At the same time, taking into consideration the technical characteristics of the pumps to be operated, it is obvious that due to the operation of the new pumps, standard noise level will not be exceeded in the working zone (85 DB).

**Social Impacts (assessed for original design)**

Construction works may cause temporary discomfort and disturb the rest of communities in the neighborhood of the scheme construction area. Noise and dust might have negative impact on the health of people living nearby the construction area. There will also be need for temporary use of community lands for equipment storage and establishment of construction camps. However, the communities will have temporary employment opportunities during the construction period.

(a) Construction related traffic increase and other nuisance to local communities

Short-term temporary disturbance of local communities is expected from the movement of construction vehicles and operation of machinery that generates noise and dust. Works will be planned so as to avoid interruption of the irrigation service provision to the clients that currently receive water for irrigation from the existing Kaghtsrashen scheme.

(b) Temporary impacts on land use

The precondition for the design implementation was to avoid alienation and resettlement impacts. However, some temporary influence is expected during works. Temporary use of the land may comprise up to 1.85 ha. The influence zone will cover the unused community lands. The affected communities have signed voluntary agreements allowing for the use of their community lands during the construction works. The construction contractor will use only community lands for construction camps. The project design avoids private land use. However, some unforeseen circumstances and obstacles may force the construction contractor to change the route of the pipeline and face the need to use private lands. In such cases the construction works will immediately be stopped and the PIU will start negotiations with the land owner to sign a voluntary easement agreement for the land use. If the land owner disagrees for his land use on voluntary basis than a Resettlement Action Plan (RAP) will be prepared in compliance with the Resettlement Policy Framework. At the end of the works the land plots will be restored and returned for use to owner/user. The servitude agreement will also provide the right to operator to access the land to address emergency and outstanding issues related to pipeline maintenance, once such need arise in future. The PIU will make relevant modifications in this ESIA report and send to WB for no objection before the construction works can restart.
(c) Temporary local employment

The positive social impact of the construction phase is the temporary employment opportunity for local non-qualified labor. The construction contractor will hire local non-qualified work-hands including women who will be interested in temporary employment such as cooking, cleaning, etc.

(d) Temporary impact on community road in Garni gorge

The road in the gorge is narrow and there is no possibility for an alternative road. The land owners in the gorge might face difficulties or inconvenience in access to their lands during the construction period.

Social Impacts expected from the Design Variation

- According to the Design Variation, by removing the headworks for 5,256 m downstream Azat River, the impact on the narrow earth road of the gorge will be considerably reduced, as 5,256 m section of the road is eliminated from the design. The landowners of the gorge will have free access to their plots; the pipeline will pass near 3 plots (out of 26 plots according to the initial design), of which only one is used by the owner for farming and living.
- The private lands of the gorge irrigated from Azat River will not be affected by the Project, except for three plots which are located downstream the headworks;
- The concerns of Garni community regarding the possible damage to tourism and small business and insufficient irrigation water quantity for the plots of the gorge are mainly solved;
- The Construction Company may implement civil works at any period of time, as civil works will not be obstacle for tourists visiting the gorge and will not disturb the traffic of the gorge.

8.2.2. Mitigation and Enhancement Measures at the Construction Phase

Environmental Impact Mitigation

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 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; zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment shall be maintained by the contractor. The Water Sector PIU and supervision consultant will supervise and enforce implementation of the permit requirements for the quarries and disposal sites through their technical supervision consultants;
- Ditches with gradient over 5% shall be reinforced by surface protection, steep slopes shall be strengthened by vegetation, grass and plants, concrete plates or gabions to avoid erosion; all vegetative cover shall be restored to its original condition preceded with appropriate stripping and storage of the top-soils in the preliminary approved sites;
- Sites for storage of oil and chemicals shall be properly equipped to minimize the risks of polluting soils and waters; dust and noise from the construction site shall be minimized especially in residential areas, public places, near schools, by using closed/covered trucks for transportation of raw/construction materials and debris. All earth works are expected to be carried out by machinery and equipment supplied with dust collectors. The vehicles and machinery must be regularly checked, tuned up and equipped with effective exhaust mufflers. Water shall be used to wet road-metal, stored and removed soils and eliminate dust as well as watering of the construction site and gravel access roads as required, except during winter and months with high precipitation.
- Provision of entrance and exit principles for the traffic and construction sites, defining the precise routes, parking areas and work implementation schedule.
- Temporary construction and domestic waste location outside the river water area to exclude waste penetration high overflow into the river. Possibly avoidance of construction works in the used river section to exclude harmful impacts on the river ecosystem. The constructor should provide special protective measures to prevent the transformation of Azat River flow, bed and banks and to prevent the degradation (for example barriers, using nets intended for the mud in order to reduce the turbidity downstream of the river, etc.).

**Construction camps**

Each construction camp should be created after the consultation with the environment specialists of the supervision consultant. Construction camps must be organized in the areas with no vegetation, temporary structures must be located parallel to the track in the areas with no vegetation, higher than the ground surface, and on the supports. Construction waste must be periodically removed.

**Removal of vegetation**

Before the commencement of the construction, decorative and fruit trees and bushes must be removed. The best period for replanting the vegetation is late autumn and winter, which are the best period from the aspect of reducing the impact on fauna and flora to the minimum. According to the botanical investigations, the tree types of the project area are not included in the Red Book of RA.

Taking into account that, the trees and bushes along the road are important from the environmental point of view, and it is a difficult work to grow trees in natural condition, it is necessary to avoid cutting trees as much as possible. Instead of the trees to be cut during the construction work (5 Willow (Osier) (Latin: *Salix*) trees and 7 Sweetbrier (Latin: *Rosa*)), new trees will be planted at a ratio of 1:3. It is very important to use the types of trees, which are resistant to the dry climatic conditions and dust emissions. Cutting of the trees and replanting must be carried out in a specified order in case of the availability of the corresponding agreements.

**Removal of the earth layer and excess topsoil**

Given that during non-vegetation period in case of damage 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 foreseen work on the natural topsoil and tree-bush vegetation. The top layer of the earth in the areas with vegetation cover will be cut by scraper and accumulated in the areas with no vegetation, and after the backfill and leveling of the trenches it will be restored to its pervious place.

The use of the excess soil for the purpose of planting and restoration of roads must be agreed with the authorities of the adjacent communities.

To minimize the impact of earth works, water spread technique will be widely used, and measures will be implemented to protect excess soils from runoff.

**Formation of solid and fluid waste**

The solid waste originated during the construction phase including remainders of the surplus cover, wrapping materials, household and other waste must be collected, removed or accumulated in accordance with the agreement provided by the local authorities.

The liquid waste includes petroleum products, recycled oils and household wastewater, etc. Household wastewater will be accumulated in temporary tanks built of waterproof materials, and will be periodically emptied as defined, in accordance with current regulations. Recycled oils will be handed to the corresponding organizations for double use.

**Oil and fuel leakage**

Oil and fuel leakage is possible when storing or refilling the machinery. A temporary fuel filling point must be organized in the construction camp during the construction work with the capacity of 1.0-2.0 ton. It will have a temporary nature and will be placed on the corresponding concrete covered platform, which will be completed with a system of leakage collecting to protect the earth cover, surface waters from pollution by the petroleum
products. It will be dismantled after the completion of the work. In case of leakages treatment work is to be carried out and MNP must be informed.

Also the construction equipment and machinery will be kept in an adequate technical condition at all times and the use of non-standard fuel will be excluded, in order to avoid oil and fuel leakage during the construction works.

**Mitigation Measures of Environmental Impacts Expected from the Design Variation**

Given the fact that the Design Variation will have only positive environmental impact compared with the previous design, there is no need to develop environmental mitigation measures for the Design Variation.

As for environmental impact mitigation of the whole design, the corresponding measures are developed and described in Chapter 8 of this ESIA report, and they are also included in the ESMP.

**Mitigation of Impacts on Cultural Heritage**

As it was mentioned, there are no historical and cultural objects in the territory that is affected by the construction works. However, if during construction work (as a result of excavation works, from the underground layers) 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.

**Social Impact Mitigation**

**Public awareness**

The construction contractor should properly inform the affected communities about the beginning of construction works in the result of which the levels of dust and noise may be added, the roads may temporary be closed and overcoming routes may be created. The contractor will also inform the affected communities about complaint procedures and/or grievance redress mechanisms through which the public can raise questions, concerns, grievances or provide other feedback about the construction process to the PIU and the contractor, and have this feedback addressed and responded to in a timely and systematic manner. The contractor and PIU should coordinate the process.

**Noise**

In sequence of other actions connected with the construction and machine equipment work, noise will appear during the construction. Its noise will be more tangible for people living nearby the roads or working in other structures. Some softening measures are defined to reduce the noise level. Those measures are the following:

- Installation of construction camps as far as possible from the inhabited areas,
- Noisy works should be carried out during day hours and making works during night hours should be avoided,
- Reduce the usage of heavy technique near the inhabited areas as possible,
- Noise absorber plants should be installed on machine equipment.

**Safety measures**

The construction work will be carried out according to the requirements and safety regulations defined by the RA legislation, as well as the requirements provided in separate sections of this document.

In order to avoid or reduce social 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,
Ensure that workers operating large equipment are properly trained and licensed
Ensure that construction equipment are 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.

**Disturbance of traffic in Garni Gorge related to Construction**

- The construction company will be obliged not to organize any construction work in the gorge within the period of May 1-October 1; the requirement will be included in the construction contract and will be strictly supervised by the WPIU
- During the construction period the construction company will ensure land owners are fully informed ahead of time of which sections of the road will be closed so as to enable them to use alternate routes to access their land.

The construction company will inform the community about the construction works, the hours of the equipment works especially at the narrow sections of the gorge to avoid disruptions to people through relevant informative posters or announcements. These requirements will be included in the construction contract. Information boards will be posted at all construction sites with contact telephone numbers for the construction company and the WPIU so that the public can easily communicate any complaints regarding disruptions related to construction works.

**Mitigation Measures of Social Impacts Expected from the Design Variation**

According to the Design Variation:
- Amendment will be made in Construction Contract to adjust the construction period (no need to limit construction works in summer season);
- The Contractor will inform the landowners about the implementation of works trying not to prevent their movement;
- Only one of the plots located downstream the head structure is irrigated from the river. The WSPIU is ready to provide water from Azat River to the given land users (their water demand is calculated in hydrological calculations).

**8.3. Operation Phase**

**8.3.1. Environmental and Social Impacts at the Operation Phase**

**Environmental Impacts**

Operation of the reconstructed irrigation scheme will carry common risks associated with irrigation for agriculture.

**(a) Soil erosion, salinization and alkalization**

Operation of Kaghtsrashen gravity scheme may have some negative impact on the lands of project affected area, particularly in terms of soils natural balance (increase of salination, alkalization, toxicity and absorption index) which may be due to irrigation water pollution and/or richness of salt or other chemical compounds, and erosion in case improper irrigation techniques are applied. Such impacts may be long term and cumulative. The quantitative and qualitative studies of irrigation water source for feeding of the Kaghtsrashen gravity scheme were carried out by FS/DD consultant at the design phase and lead to the following conclusions:
- The aquifers within the area served by the system will not have a significant impact on the ecological
balance of “soil-plant-water” system. It is expected that the penetration of irrigation waters into ground water will not influence the chemical composition of the latter.

- The irrigated arable lands of the affected area are generally not prone to erosion. Usually the top layer is subject to erosion. Moderate and, in extreme cases - severe - erosion is observed on the steep slopes.

(b) Deterioration of irrigation water quality

The lands to be irrigated by Kaghtsrashen gravity scheme are located within the range of 800-1,100 m above sea level. There are no industrial and significant residential polluters upstream the designed water intake. Testing of Azat River water quality, carried out for the purpose of developing the Kaghtsrashen gravity scheme, shows that the water is not polluted with organic, mineral, or toxic pollutants. Deterioration of the water quality is unlikely over the course of the proposed scheme’s lifetime, and no significant accidental spills can occur upstream either.

(c) Increased use of pesticides

Improved provision of irrigation services and return of some area to irrigation after years of discontinued service are likely to intensify farming in the Kaghtsrashen scheme command area. This may indirectly influence the pattern of agrochemical’s use. Potentially increased and improper use of pesticides carries risks of environment pollution and threats to human health.

(d) Biodiversity

No plant species registered in the RA Red Book are discovered immediately in the areas of work implementation and pipelines routing, nevertheless, the gorge of the river Azat is a quite vulnerable ecosystem, moreover, the water-intake area and a part of pipeline will be located near the Khosrov Forest State Reserve which has a unique biodiversity. The reserve’s flora is rich in rare and endangered plant species, 80 of which are included into the Armenian Red Book. 34 of them are considered rare or are close to extinction. Currently 30 mammal species live in the Khosrov Forest State Reserve, 4 of which are registered in the Armenian fauna Red Book and 1 – in the International Red List. The avifauna of the reserve includes 192 bird species. Five species are registered in the International Red Book and 37 species – in the Armenian Red Book, which makes up 55 percent of birds included into the Armenian Red Book. There are 33 reptile species within the reserve area, 5 of which are registered in the Armenian Red Book and 2 – in the International Red Book. Five amphibian species live within the reserve area, 1 of which is registered in the Armenian Red Book. Nine fish species occur in Azat River, and they are not registered into the Armenian Red Book. All the above-mentioned species are outside of the project area of influence, given that the private lands of 60-70 m width, located between the project implementation area and the State Reserve will serve as buffer zone, which will not allow expansion of the negative impact to the territory of the Khosrost Forest Stare Reserve.

(e) Specially Protected Natural Areas

The project is directly related to the following Specially Protected Natural Areas:

1. “Khosrov Forest” State Reserve.

“Khosrov Forest” State Reserve was founded in 1958. It has high-value ecosystems and is considered as one of the best protected areas in the RA. It occupies the surface area of about 23,213.5 ha and, unlike other protected areas in the RA, has a management plan in force. According to the IUCN classification, this protected area falls under category “Ia”. As Khosrov Forest State Reserve stretches along the left bank of the river Azat and the Kaghtsrashen Gravity Irrigation Scheme pipeline runs along the right bank of the river it will not have direct impact or relevance to the actual area of the Reserve. The territory of the Reserve, which is not too far from the project area of influence is not distinguished with diversity of fauna and it is highly unlikely place of occurrence of fauna species, including their migration routes. This is due to the peculiarities of the gorge. Also, in the period of April-November there is intensive presence of tourist in the gorge, as well as farmers, which use transportation and machinery for their farmlands.

Nevertheless, taking into consideration the fact that the Project will anyway be related to the buffer zone of the Reserve, prior to the Project implementation, the design company, in a manner prescribed by the Law, submitted the design concept for an opinion to the RA Ministry of Nature Protection, which is the authorized body for the
development of the protected areas policy in the RA. The latter had no objections to the Project design, mentioning only that, in accordance with the established procedure, the design shall be subject to the environmental expert examination and it will be taken into account by the designer. This requirement is envisaged according to the Republic of Armenia new law “On Environmental Impact Assessment and Expertise”, which is in force since 2014. The law defined all types of activities, which are subject to expertise. The Ministry of Nature Protection, which is in charge of the development and implementation of the overall policy in this field, implements some of the functions through its State Non-Commercial Organizations (SNCO). One of such SNCOs is the “Environmental Impact Expertise Center”, where this design was subject to environmental expertise and received positive conclusion.

The Charter of Khosrov Forest State Reserve was approved by the Resolution No.925-N of the GOA dated March 30, 2002. According to that Resolution the protection (buffer) zone of the State Reserve is confined by the watershed lines of Vedi River and Khosrov River within the area allocated for the reserve. Any type of economic activity agreed with the competent state authority is allowed within the buffer zone of the reserve, provided that it does not harm ecological system of the reserve and its natural development. Thus, the design team has conducted specialized assessment, according to which the expected damage to the buffer zone will be excluded or minimized. This is also proven with the positive conclusion from the “Environmental Impact Expertise Center” SNCO, and also the results of public discussions with participation of the environmental NGOs, local population, PIU specialists and the design consultants. As of today, none of the stakeholders has not provided any evidence of possible damage to the ecology of the buffer zone.

2. Bazalt Organ Natural Monument;
3. Unnamed cave Natural Monument;
4. Unnamed slope erosion Natural Monument;
5. Unnamed lava folds Natural Monument.

This monuments are included in the List of Monuments of Geological Type (N 38, 39, 40, 41) approved as the Annex to the RA Government Decision N 967-N of August 14, 2008. However, for all of these natural monuments the size of the territory, exact boundaries, description of the protected zone and protection regimes are not defined yet. According to the official correspondence with the Ministry of Nature Protection of Armenia, the size of the territory, exact boundaries, description of the protected zone and protection regimes for the above-mentioned natural monuments will be defined in the period of 2019-2021. In addition to this, based on the official information from the Ministry of Nature Protection, the below map of locations has been prepared.

*Two other natural monuments are upstream of the intake structure, flooding area and the Kaghsrashen pipeline; hence they cannot be affected and are not depicted in this map.
As the map shows, all monuments are outside of the impact area of the Kaghstrashen gravity irrigation scheme, including the potential flooding zone. Also, these natural monuments cannot be damaged during pipeline construction, as the closest point, provided by geographic coordinates of the natural monuments, is located at least few hundred meters far from the Kaghstrashen scheme.

(f) Water Resources

The river Azat is the work implementation site. A part of the construction works - the water-intake structure is located right in the riverbed, as for the other works related to pipeline installation, they will be carried out on the river bank. During this period, though for a short time, the river waters will be polluted, banks and adjacent top layer soil can be damaged.

During the operation of the gravity system, even as a result of normative water-intake, the river water stream will be reduced, the ecosystem of the river will be subject to changes, while the excessive water-intake can cause significant damage.

During the operation of canal, because of the heavy rains, the outflows of the livestock farms and processing plants could come to the canal and pollute the water.

There is one farm in the area, which is engaged in cattle breeding. Other household animals also can graze in this area. To provide their movement, it is necessary to develop special measures.

The section 4.4 on hydrology also shows that no considerable impact on water quality is expected during the operation of the gravity system, given the absence of significant anthropogenic pressures in the vicinity and the fact that the environmental flow will always be maintained. However, some limited impact on quality of Azat River at the water-intake structure site is expected during the actual construction. During this short period, water of the river might get slightly polluted, and the banks and adjacent top layer soil can be damaged.

The impact of Kaghtsrashen Gravity scheme on water resources is also discussed in detail in section 4.4 on hydrology. Particularly, it is shown that the operation of the gravity scheme water withdrawal of Kaghtsrashen system in the months April-October will reduce the flow in Azat River, but the impact will not be significant, and both the environmental flow and downstream water use requirements will be maintained at all times.

Also, as already mentioned that are some migratory fish species in Azat River (Salmo trutta fario, Vimba vimba, Rutilus rutilus schelkovnikovi, Varicorhinus capoeta.), which are not registered in the “Red Book of Plants and Animals of RA”. To ensure the continued possibility of migration for these fish species corresponding ladder is planned for construction during the construction of the head water intake structure.

Environmental Flow

One of the main criteria used for impact assessment on Azat River was the environmental flow (minimal flow to be left in the river bed after abstraction), which was determined as required by the national legislation and in accordance with the Decree of the Government of RA no. 927 dated 30.06.2011. According to this Decree, the environmental flow is defined as the average daily discharge of the 10 successive days with the lowest discharge. It is a fixed amount over time (usually coincides with the period when there is no anthropogenic pressure on the river flow and conditions under which the aquatic life exists in the Armenian rivers) and guaranteed even during drought years. Applying the established methodology, the environmental flow for Azat River in the section of the water intake of the Kaghtsrashen gravity scheme and downstream of it is set at 0.85 m$^3$/sec or 2.23 mln m$^3$ per month, or 26.81 mln m$^3$ annually.

Figures below illustrate the river flow before and after abstraction by the gravity scheme below the proposed intake for different water availability years (50% and 75% probabilities).
Figure 4. Comparison of the impact on Azat River flow below the Kaghtsrashen Gravity Scheme intake point before and after the project for the average-water year with 50% probability, mln m$^3$

Figure 5. Comparison of the impact on Azat River below the Kaghtsrashen Gravity Scheme intake point before and after the project for the low-water year with 75% probability of occurrence

The percentage in the above-mentioned graphs indicates the part of flow that will remain after implementing the Kaghstrashen Gravity Scheme project.
As seen from the table of water economic balances and the graphs above, on average, sufficient flow is maintained in the river throughout the year. Even in the worst case of the month August almost half of the flow (58%) still remains in the river after the project, meaning that both the environmental flow and downstream water use requirements are met.

According to expert assessment, with the defined environmental flow of 0.88 mil. m³ per month or 27.77 mil. m³ per year the aquatic ecology of the river has already performed well (for example in February, where the anthropogenic impact on the river is almost absent the fish and other aquatic fauna develop in the river), whereas the project will leave much more water than required by the flow requirement. Thus, for average year the annual quantity of environmental flow is 27.77 mil. m³, whereas after the project 130.25 mil. m³ will be available annually.

Additional 378 ha of lands will be irrigated under the proposed Project, and the requirements of the environmental flow are sufficient both for average year and for low water year (75% probability).

(g) Soil

The soil cover will be damaged during the movement of construction machinery, earthworks, building of construction sites, pipeline installation, storage and usage of construction materials, fuel and lubricants.

Kaghtsrashen gravity scheme is planned for irrigating 1,232 ha of agricultural lands in 12 communities in Azat River basin: Narek, Kaghtsrashen, Getazat, Aygestan, Deghdzut, Norashen Berdik, Nerqin Dvin, Hnaberd, Vardashen, Mrganush, and Verin Dvin. All of these communities are within the service area of “Artashat” WUA. This will replace current mechanical irrigation of 854 ha of agricultural lands and will include 378 ha of new agricultural lands due to increased irrigation efficiency.

Currently different types of fruits, vineyards, and vegetables are cultivated in these communities. They grow tomato, beetroot, eggplant, watermelon, melon and wheat. Some of the communities cultivate their spare lands as gardens, arable lands.

In the areas that are already irrigated, the crop composition and the processing methods are not going to be changed. Regional Municipality implements the programs, the objective of which is to introduce the villagers with the irrigation modern and saving methods.

In the mentioned villages as a fertilizer is mainly used the manure. Periodically the Government of RA provides subsidized nitrogen fertilizers, but this is not being done on a regular basis. So is the use of pesticides.

The majority of households, due to the difficult financial conditions, absolutely don’t use the pesticides, or they use it in only in extreme situations, when certain problems occur.

The Municipality and the regional administration provide only the consultation and as it were mentioned above, the particular assistance programs. There is no management system for pesticides. According to a preliminary study, the operation of Kaghtsrashen irrigation system will not cause any change to the range of crops, as well as to the soil quality.

(h) Impacts on Cultural Heritage and Tourism Potential

As it was mentioned above, in the adjacent territories of the irrigation system, about 1.5-2 km far away there are located historical, cultural and natural monuments that attract the tourists, and the project implementation will not have a significant negative impact on them. The construction works of the intended project will be implemented in accordance with all current regulations of RA and all required distances will be maintained. As for the tourism activities, the construction works are planned to be carried out on September-November and March-May months, which are out of the tourism season. To provide an unobstructed traffic in Azat canyon during these works, it is planned to hang the relevant information boards in Garni Community, which will inform the public about the construction works and will provide them an information how to organize their traffic along the road through the gorge (nowadays there are 3 roads to Azat canyon, and during the project implementation they will serve both the community and tourists in a shift mode.) By the program it is planned to build a water intake station in a head structure with over 2m high dam, in case of which there will occur a small pond of about 1385 square
meters, which will be an additional stimulus for the tourism and one-day visitors, and also will create a favorable environment and an improved microclimate in that part of Azat canyon.

Social Impacts
Kaghtsrashen gravity irrigation scheme is expected to have a positive social impact on agricultural development in the affected communities. The availability of quality irrigation water will contribute to agricultural and social-economic development of the target communities. Agriculture is the main source of income for most of the households especially women headed households and vulnerable groups who will be able to irrigate new lands, to cultivate more profitable crops and improve their livelihoods. It will slow down migration rates and will open perspectives for people who intended to leave their homelands for seasonal works or permanent living. They will have better opportunities for farming, agricultural production and trading. There will be more opportunities for vulnerable groups and youth to find seasonal employment as work-hands on private or leased farmlands.

(a) Impact on Ararat Marz Communities
Aygestan, Berdik, Gatazat, Deghdzut, Hnaberd, Nerkin Dvin, Norashen, Verin Dvin, Vardashen, Mrganush, Kaghtsrashen and Narek communities

The Consultant conducted group discussions and studies at 12 affected communities of Ararat Marz in June 2014 to identify the existing social issues related to irrigation and to assess social impact of the project on the communities. The discussions were held in village mayors’ offices with the participation of the affected communities’ leaders, Artashat WUA representatives, male and female representatives of various layers of communities (22-30 participants at different communities).

All participants of discussions assessed the construction of gravity irrigation scheme as a positive project. All communities have irrigation water shortage. Due to dilapidated and poor condition of irrigation network, especially tertiary canals, the farmers are unable to irrigate all their lands, while the lands located at the end of canals hardly receive any water. The construction of gravity irrigation scheme will promote social-economic development of the communities. They plan irrigation of new lands and cultivation of more profitable crops which can contribute to reduction of migration rates. The leaders of affected communities have submitted their agreements about the use of their community lands for construction of the gravity scheme (Agreements are presented in Annex 3).

(b) Impact on Garni Community

The representatives of “Armhydroenergyproject” CJSC and the PIU had several meetings with Garni community, farmers and council members to assess the social and environmental impact of the Kaghtsrashen Gravity Irrigation Scheme project on the community.

A first public consultation meeting on Kaghtsrashen Gravity Scheme in Garni community was held on December 10, after placing an announcement in “The Republic of Armenia” daily newspaper (December 2nd issue) and in the PIU website a week prior to the event. Approximately 150-200 people participated in the meeting and expressed several concerns related to the project, notably:

1) Concern that the Project was working to address the irrigation problems of Ararat marz communities, while Garni community itself faces irrigation water deficit and was being asked to provide use of community lands to the Project, while not benefitting directly from it.

2) Concern over the proposed location of the head-structure, and mistrust in hydrological calculations and hydrological measurements undertaken by the ArmStateHydromet. In particular, community members the worried about possible negative impact of the project on tourism in the Garni canyon, doubted the process of setting environmental flow and proper compliance assurance of the flow requirements, and stated their concern on possible deterioration of water quality in the head-structure section due to reduced water quantity.

To address the above-mentioned concerns, which were mostly due to insufficient confidence and trust, the PIU undertook several confidence-building measures, including demonstration measurements with Hydromet specialists with participation of Garni community residents, additional field surveys (again with participation of the concerned residents of Garni), water quality measurements, additional rounds of discussions and clarifications,
as well as proper communication of the project objectives, details and expected outcomes. Details of the measures undertaken are described in Annex 4 (section 10) of this ESIA report.

Another public meeting was held in Garni municipality on February 18, 2015 with the participation of community, as well as mass media representatives. Again, several concerns related to the potential impact of the project on Garni community were raised.

To fully understand and engage further with the community, the PIU in collaboration with members of the WB task team met twice with the Garni community leader and community representatives in October 2014 and March 2015, to listen to community concerns and provide information on the environmental and social safeguards applied to the project.

Taking into consideration the above-mentioned concerns of the Garni community residents, the PIU initiated several measures and activities to address those concerns and build the community ownership in Kaghstrashen gravity irrigation scheme project (see Annex 4). These activities helped to better explain the project objectives and likely impacts to the community and to reassure community members as to the hydrology calculations and safeguards in place.

As a result of these activities implemented by the PIU to address the concerns of the Garni community residents, as well as clarification on several issues raised by the residents, the Garni Community Council gave its formal approval to use the Garni community lands for the proposed Kaghstrashen gravity irrigation scheme project in its Community Council Session of April 9, 2015 (see agreement in Annex 3).

(c) Water leakage

It is also important to properly monitor the operation of the pipeline to avoid water leakage, which might affect livelihoods of vulnerable people, including female-headed households. To exclude these phenomena, it is necessary to undertake the following mitigation measures.

8.3.2. Mitigation and Enhancement Measures at the Operation Phase

Environmental Impact Mitigation

Prevention of flooding from poor maintenance of hydraulic structures

During operation it is essential that the head water intake structure, pipelines, and other structures be regularly inspected and be periodically maintained to ensure proper conveyance, avoid stagnation and prevent waterlogging. The water intake should be regulated to provide the water usage as permitted.

Preventing alkalization, salinization, and erosion

Because flood irrigation is the main technology applied in the service area of the Kaghstrashen scheme, there is a risk of erosion and waterlogging that may also lead to salinization or alkalization of soil. To prevent erosion in the command area of the Kaghstrashen gravity system, anti-erosion measures should be built into the crop cultivation practices. These imply sowing horizontally across the slopes, applying dense sowing practice, furrowing and bedding, and irrigating by short furrows according to the established norms.

Command areas that are characterized with high water table or are otherwise prone to waterlogging, should be provided drainage systems allowing timely evacuation of excessive water from the plots.

Maintaining the quality of irrigation water

Quality of the water to be supplied through the Kaghstrashen gravity scheme will depend on its source, which is Azat River. Monitoring of Azat River water quality is carried out by the Environmental Impact Monitoring Centre (EIMC) of RA Ministry of Nature Protection. “Artashat” WUA, which will be operator of the Kaghstrashen gravity scheme, will follow the information provided in these sites and will inform the community leaders about the water quality fluctuations.
In an unlikely case of tangible deterioration of irrigation water quality, WUA will approach the Ministry of Nature Protection, and/or local authorities for identifying sources of pollution, addressing causes of pollution to the extent possible, and undertaking relevant corrective measures for land reclamation.

**Managing impact on aquatic life from excessive water intake**

Azat River flow has severely expressed seasonal prevalence. Observance of the environmental water flow will prevent significant negative impacts on the aquatic ecosystem, given that under such conditions the aquatic ecosystem has functioned normally. Moreover, on an annual basis the project will leave 4 times more water than is required by the environmental flow requirements (111.7 mln m$^3$ instead of 26.81 mln m$^3$). As shown in the hydrographs above, the seasonal variation of the river flow will also be retained after the project. This is true for even unusually dry years, when in the month of August, despite the expected irrigation water deficit by 13%, the environmental flow will still be maintained.

“Artashat” WUA implements the management of the irrigation water supply; system operation and maintenance, prevention of the pollution of the water resources and their restoration. Measures of the water intake are defined, as well as calculations of the intake are controlled based on the approval of the “Water resource management and maintenance” authorized body. Calculation of the supplied water is carried out with a water meter.

After the State Environmental Examination of the Kaghtsrashen scheme design, the “Artashat” WUA must provide the local environmental inspection the approved Management Plan, and the local inspection will supervise adherence to the Management Plan thereinafter, including maintenance of the environmental flow in the river, given the plans to install SCADA automated management system in the head structure area. This will make it possible to the state compliance assurance authorities, as well as the Garni community residents to track the compliance with the water use permit conditions and maintenance of the environmental flow in an on-line regime.

**Managing impacts of improved irrigation service delivery on agro-production**

“Amelioration” LLC, working for the SCWE, supervises the quantity of agrochemical and pesticide use; assures safe land use; and monitors composition, structure and salt content of ameliorated lands.

Promotion of good pest and pesticide management practices is included into the project design. A library of brochures, fliers, and posters on the sound and safe handling of pesticides, including information on the Integrated Pest Management (IPM), has accumulated as a depository of outputs from a number of rural development projects implemented in Armenia with support of the World Bank and other international/bilateral financiers. This material is readily available for reproduction for the needs of ISEP. Posters promoting good pest and pesticide management will be displayed in the premises of WUA offices. Brochures and leaflets will also be available at the WUA offices and the points of trade of agrochemicals. Selected publications on the environmental and public health implications of pesticide use will be used as a supplemental teaching material in rural schools. WUAs will play pivotal role in promotion of good agricultural practice. Additional technical assistance for the extension of IPM will be sought through other ongoing agricultural projects, including the Bank-financed Community Agricultural Resource Management and Competitiveness. Thus, it is planned to develop cooperation between the teams of similar projects. In addition, since 2014 in the service areas of the WUAs social survey activities are initiated using the internal resources of the Water Sector PIU (the first one being in the territory of the “Masis” WUA), which later on will be further elaborated and expanded. In these survey IPMs will also be reflected, and possibility will be provided to have a direct exchange of information with farmers on these issues.

**Social Impact Mitigation**

**Social Impacts Mitigation for Garni Community**

The project might have impact on land users in Garni gorge as they irrigate their lands with the river water. During low water years the farmers in the gorge might face the challenge of taking water for irrigation of their lands from the river in August as there will be only minimal environmental flow left in the river.

The project has considered this fact and as a social impact mitigation measure WSPIU is ready to:

- Provide water from Azat River to all land users in the gorge (their water demand has been calculated in hydrological estimates).
- Include Garni canal as well as the tertiary irrigation network rehabilitation in the upcoming project to
decrease the irrigation water loss to minimum and to increase water supply for about 30-35% enabling
the community to irrigate more lands.

**Excessive Water Intake**

The PIU will organize ongoing and regular consultation with Garni community to monitor the water level and prevent excessive intake. The community will be informed how to follow the intake process online through the SCADA system.

**Quick response to alarm on leakage**

In case of emergency situations rehabilitation of losses caused to community or individuals should be urgently implemented. “Artashat” WUA responsible for the maintenance of the pipeline will undertake rehabilitation activities. If the affected persons are not satisfied with the works conducted by the WUA they can solve the case through the court. Compensation can be paid only with the decision of the court.

**8.4 Decommissioning Phase**

Useful life of Kaghtsrashen gravity system is estimated at 50 years. At the decommissioning phase of the Kaghtsrashen gravity system, waste will be generated from dismantling pipelines and other structures, which may have a temporary or permanent impact on adjacent lands. Soils may be disrupted in the process of dismantling the pipelines and other structures, causing further degradation if not restored. Social and economic welfare of water users served by the Kaghtsrashen gravity system may be adversely affected if no alternative means of water supply are provided.

Waste generated during the dismantling of Kaghtsrashen gravity irrigation system shall be stored and disposed in accordance with the requirements of the permits and/or agreements to be obtained from the State authorities. Disrupted soils (excavated soils, trenches, camps, etc.) shall be restored to their original state in order to prevent their degradation and temporary air pollution and disturbance of population and biodiversity of adjacent areas related to the transportation of dismantled gravity system shall be regulated by implementation of the specific measures developed (schedule of the construction works, traffic management plan, etc.). Alternative means of irrigation water supply shall be provided for command areas in order to maintain the social and economic welfare of the affected communities.
Chapter 9. Beneficiary Feedback and Grievance Redress

The grievance redress mechanism (GRM) is a mechanism 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 costs. 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 grievance 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.

Grievance Redress Mechanism

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 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 engineer 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. The information on the GRM as well as the hotline will be communicated to the communities and households who will be affected by the Kaghstrashen 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.

**Application of Grievance Redress Mechanism**

The WS PIU has started to implement the mitigation measures since April, 2016.

- The contact details of the Grievance Redress Mechanism (GRM) which include the contact details of the SCWE, PIU and the WB were posted in the municipalities of the affected communities and in those sections of the gorge where the Contractor intends to commence civil works.
- The GRM log was submitted to the specialists of the WSPIU, Contractor and Technical Supervisor. All of them were informed that all kinds of complains, recommendations and feedbacks should be recorded and answered on time.
- On April 04, 2016 with the PIU support the short-term expert of the WB conducted training for the Contractors. The Engineers of 3 Construction Companies, Technical Supervisor and the PIU participated in the training. On April 26, 2016, the WSPIU Environmental and Social Specialists organized another meeting/training for 3 Construction Companies and the Technical Supervisor to explain that the requirements of ESIA report, ESMP and RPF should be followed.
- On April 6, 2016, the PIU Social Specialist with the PIU Construction Coordination Engineer, PIU Technical Supervision Engineer, the Deputy Team Leader of Garni community and some landowners visited Garni Gorge to capture and video the private assets along the road. The participants signed under the protocol on capturing the private assets.
- The Contractor made an agreement with the Avetisyanys on the temporary use of their land and informed the PIU about it. The representatives of the WSPIU spoke with the landowner and his wife and found out, that they had really understood that no compensation was foreseen under the Voluntary Agreement.
provided that any accidental damage to their asset will be recoverd. Their family also have temporary employment opportunity: the Contractor has hired Albert Avetisyan, his son and wife. A Voluntary Agreement was signed between the PIU, the Contractor and the landowner on free of charge use of unused lands and recovery of accidentally damaged asset. The signed agreement was sent to the World Bank (Voluntary Easement Agreement is presented in Annex 3 of this report).
Chapter 10. Public Consultation Process

Public Discussions in Affected Communities

Public discussions on Kaghtsrashen irrigation gravity scheme were organized on November 25, 2014 with participants from Ararat Marz communities in Artashat. Ararat Marzpet (Governor) R. Abrahanyan, Acting Director of WSPIU F. Melikyan, representatives of the Consultant Company, WSPIU and Aygestan, Berdik, Getazat, Deghdzut, Hnaberd, Mrganush, Narek, Nerkin Dvin, Norashen, Vardashen, Verin Dvin, Kaghtsrashen communities. The public consultation meetings were chaired by the Regional Governor of Ararat Marz of Armenia and the Acting Director of Water Sector PIU. The specialists of the Consultant and PIU presented the technical description of the project, potential environmental and social impacts and mitigation measures. The presentations were followed by discussions, and question and answer session with active participation of the representatives of the participating communities. The Minutes of the discussions is presented in Annex 2.

The announcement on the public consultation was published in “The Republic of Armenia” daily newspaper in November 18th issue and was posted in municipalities of Ararat Marz and communities.

The objective of public consultation was to discuss Kaghtsrashen irrigation gravity scheme project and related environmental and social issues. During the consultation the contractor presented the draft project and envisaged activities, possible negative impacts and mitigation measures, the importance of the project for local population, expected results, etc.

There were also several public discussions held in Garni community to discuss the project design, social and environmental issues given the community’s concerns about the project.

On December 10th the consultant organized Public Consultation on Kaghtsrashen Gravity Scheme in Garni community after placing an announcement in “The Republic of Armenia”, daily newspaper, December 2nd issue and in the PIU website a week prior to the event. There were about 150-200 people gathered at the place of public discussions. However, they didn’t allow the discussions to take place. Because the River Azat starts at other communities and only flows through the Garni gorge, the Garni community is unable to use the water to irrigate their lands in the highlands apart from a few landowners in the gorge who use the river water and may get water from the gravity scheme provided.

Public consultations were also held on December 20th by the State Environmental Expert Examination Center in compliance with the defined procedures for environmental expertise in Garni and Artashat for Ararat communities. The Center required the minutes be prepared and submitted by the local communities, again in compliance with their procedures. Thus, Garni community prepared the “Minutes” but in its nature it is more likely to be a letter-complaint rather than “minutes”. During the public discussion the PIU staff and the Consultant gave answers to the raised issues which was not reflected in the minutes.

Another public meeting was held in Garni municipality on February 18th 2016, with participation of the community, mass media representatives during which the consultant, PIU and a Water Resources Expert tried to present water resources data, to explain the details of water intake structure which will help to ensure environmental flow in the river. The team also talked about the plans of including Garni community in the upcoming project of rehabilitation of Garni main canal and tertiary canals which will decrease the loss of water with 30-40% and will enable the community to irrigate more lands.

Meanwhile the community leader, expressing the opinion of the vast majority of community members, asked for some solution to their water needs. As the most realistic viable option to potentially increase the irrigation water supply to Garni community, the PIU suggested to include rehabilitation of Garni canal and internal distribution network in the feasibility study of the ISMP project financed by the Eurasian Development Bank. The perspective of having increased water for irrigation after the rehabilitation of canals encouraged him to discuss the issues with the council representing the community.

Thus, on February 23rd the PIU received Garni community agreement signed by the community leader as well as the community council decision for community land use during the construction of the gravity scheme.
However, there is still a need to develop and communicate effective messages to address the concerns of several people in the community. The PIU will develop comprehensive communication materials and will disseminate them in the affected communities. The PIU will also conduct ongoing public outreach to raise the awareness of the communities on details of environmental and social aspects.

After getting clearance of this ESIA report from the World Bank, another round of public consultations will be organized on the ESIA report. One of the public consultation meetings will be organized in Garni community (for the representatives from the Kotayq marz) and the other one in Ararat community (for the representatives of Ararat marz). These public consultation meetings will be organized in accordance with the World bank procedures and policies, as well as the requirements of the Armenian legislation, keeping in mind the required timeline for publication, organization of public consultation meeting, discussions and obtaining comments.

Public Consultation Meetings and Discussions on the Design Variation

First informal public consultation meeting was held on June 27, 2016, during which the PIU Specialists with a group of inhabitants of Garni community (including Arusyak Ayvazyan and Sara Petrosyan) visited the gorge of Azat River to get familiarized with the new design solutions and the compromising option. The PIU Specialist presented the envisaged changes which will solve and dispel all the concerns previously raised by the inhabitants of Garni community. They were mostly acceptable to the inhabitants (except for Arusyak Ayvazyan).

Public consultation meetings on the Design Variation were also undertaken by the PIU after Local Government elections, in the frames of which there were meetings with some inhabitants of Garni community opposing the previous design of Kaghtsrashen Gravity Scheme and with newly elected Mayor. The latter had no principal objections to the amended option and characterised it as a new compromising option resulted from their struggle which will exclude or minimize the previous hazards threatening the environment, land owners of the gorge and the ecosystem of the river.

The next meeting and discussions on the Design Variation were held on November 14, 2016 with the WB mission group, representatives of the PIU, inhabitants of Garni community and newly elected Mayor and Council. First, there was a visit to the headworks of the Design Variation, where the PIU Specialists presented the proposed solutions and implementation steps of the compromise solution to the WB mission. On-site discussions were held, during which potential design risks were addressed and there was an agreement to discuss additionally some indicators with the relevant members of the WB mission. Afterwards, on the same day there was also a meeting with the participation of the members of the WB mission, WSPIU, new Mayor and community members. The Leader of the WB mission briefly introduced the objective of their mission and after congratulating the newly elected Mayor asked about the latter’s and community members’ position on the proposed compromising option.
The new Mayor of Garni gave preliminary verbal agreement on the presented Design Variation on behalf of himself and community reminding that the previous council had also made a decision on locating the headworks on the same site as it is envisaged under the Design Variation. He assured that the proposed compromising solution will be acceptable to the inhabitants of Garni community. The latter also emphasized the importance of further collaboration and asked to speed up the rehabilitation works of Garni main canal and tertiary network.

By the way, active public discussions also had been held before the approval of the previous design of Kaghtsrashen Scheme. Particularly, prior to the WB’s approval of the final ESIA report of Kaghtsrashen Gravity Scheme, upon the request of the World Bank, for about a year the WS PIU of the SCWE organized and conducted meetings, public consultations of different formats in Garni community, in the other beneficiary communities and in Yerevan with the participation of the inhabitants of Garni community opposing to the Project. The details of the report were presented to the participants and all the questions were answered and explained. The Project details were also presented to the public through information materials and leaflets of frequently asked questions on Kaghtsrashen Gravity Scheme. During the last public consultation meeting held on January 22, 2016 in Yerevan, there were no questions on environmental and social aspects which would require new studies and mitigation measures under the ESIA of the presented Project. The document was not amended and after receiving the WB’s final approval it was disclosed in the website of the WSPIU.

Chapter 11. Institutional Responsibilities

11.1 Agencies

Executing agencies

Executing agencies are responsible for carrying out mitigation measures prescribed through the ESIA report and EMP. 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) will be responsible for executing monitoring measures provided in EMP 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 RA current Environmental and Social Legislation. Besides, the construction contractors should realize the special technical conditions included in their contracts so as they are presented in the Annex of the given document.

Supervising agencies
Acting in the capacity of the Project implementing entity, SCWS 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 RA legislation, the technical supervision of construction may be carried out exclusively by a license company. 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 project stakeholders and NGOs.

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 Syunik. The specialists will implement environmental supervision in the Project implementation area both during the construction and future operation stages.

State enforcement agencies

State agencies mandated to enforce the national legislation, norms, and standards pertaining the planned works of Meghri irrigation scheme are the following:
- State Environmental Inspectorate 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.

Monitoring executing agencies

Monitoring executing agencies are responsible for the realization of mitigation and improvement measures and efficiency level monitoring and also for further correspondence of the project in case if required. Monitoring executing agencies are responsible for the realization of all the required measures. State agencies may also carry out monitoring within their authority.

11.2 Reporting Responsibilities and Schedule

Author of the scheme design and the construction supervision consultant report to PIU on the progress of construction works. Environmental and social monitoring of works included in the assignment of the supervision consultant. The consultant reports to PIU on the project progress on a 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 that may occur during construction (accident report form also attached hereby in Annex C) immediately upon occurrence of such accident. PIU provides the World Bank with by-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

The Environmental Management Plan (EMP) attached to the present ESIA report 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.
Chapter 12. Annexes

Annex 1. A. Environmental and Social Management Plan
Annex 1. B. Monitoring Plan
Annex 2. Minutes of Public Consultations
Annex 3. Correspondence with State and Local Governance Entities and Agreements
Annex 4. Correspondence with Garni Community Leader
Annex 5. Environmental Expert Conclusion
Annex 6. Land ownership cadastral maps
Annex 7. Hydrological data from Azat-Garni post
Annex 8. Calculation basis/methods of reduced emissions due to the design variation
Annex 9. List of Reference
### Annex 1. A. Environmental and Social Management Plan

<table>
<thead>
<tr>
<th>Potential adverse impact</th>
<th>Environmental and social impacts mitigation or monitoring measures</th>
<th>Implementing Agency</th>
<th>Supervising Agency</th>
<th>Costs</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water and soil pollution and landscape deterioration resulting from improper removal of excavated soil and construction wastes</td>
<td>Ensure obtaining of proper permits for the removal of excavated soil and construction wastes, use of water resources and water systems, etc.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
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<tr>
<td></td>
<td>Prepare instructions on protection of excavated soil layer, reduction or exclusion of damage to the landscapes, as well as storing wastes of different origins, at the same time communicating these instructions to the workers, as well as ensure the access of the instructions and this Environmental Management Plan (EMP) for the entire staff.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
</tr>
<tr>
<td>Landscape changes and soil erosion</td>
<td>Develop measures for reinforcement of big slopes with vegetation (trees, bushes, herbs) or hydraulic works baskets. During vegetative cover restoration, the plant species typical for the landscape shall be considered and used.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
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<td></td>
<td>Develop the efficient methods for the transportation and backfill of the excavated soil.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
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<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
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<td>Impact on biodiversity</td>
<td>Ensure the existence of fish pass and a net to close the access of fish into head water intake structure.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
</tr>
<tr>
<td></td>
<td>Provide for relevant passage routes/bridges in the open sections of the system in order not to disturb the animal migration routes, and limitation of construction works during the nesting season.</td>
<td>Design Company</td>
<td>WSPIU</td>
<td>Regular Design Costs</td>
<td>In design stage</td>
</tr>
<tr>
<td>Temporary or permanent need for use of private or public lands or property for the Project implementation</td>
<td>Prepare and implement RAP if necessary or acquire easement for the temporary or permanent use of community and private lands. Ensure ongoing communications to communities and promote awareness of grievance redress mechanism.</td>
<td>WSPiU and/or WUA</td>
<td>Municipalities/ Governors' Offices Community Administrations</td>
<td>Other Project costs</td>
<td>In design stage, prior to commencement of construction activities. Construction activities are not permitted to commence prior to full RAP implementation.</td>
</tr>
</tbody>
</table>

**Construction phase**
<table>
<thead>
<tr>
<th>Potential adverse impact</th>
<th>Environmental and social impacts mitigation or monitoring measures</th>
<th>Implementing Agency</th>
<th>Supervising Agency</th>
<th>Costs</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary community land use for establishment of construction camps</td>
<td>Acquire community agreement on temporary use of community lands for construction camps; Installation of construction camps as far as possible from the inhabited areas.</td>
<td>Construction company</td>
<td>WSD PIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Potential exclusion of women from temporary job opportunities created by the Project</td>
<td>Contractor to promote gender-sensitive job opportunities related to construction, including catering and cleaning.</td>
<td>Construction company</td>
<td>WSPIU, Community Administration</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Water and soil pollution and landscape deterioration resulting from improper removal of excavated soil or construction wastes</td>
<td>Arrange the initial waste stockpiles in the areas free from vegetation.</td>
<td>Construction company</td>
<td>WSPIU, Community Administration</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td></td>
<td>Arranging the transport operation and construction wastes removal as per defined Traffic Management Plan and procedure, in landfills preliminarily allocated for the purpose. During the actual construction works the exact location and distance of the temporary landfills will be clarified and finalized in agreement with the communities</td>
<td>Construction company</td>
<td>WSPIU, Community Administration</td>
<td>Regular costs for construction activities</td>
<td>After obtaining permits, during construction activities</td>
</tr>
<tr>
<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
<td>Supervising Agency</td>
<td>Costs</td>
<td>Period</td>
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</tr>
<tr>
<td>Maintain the relevant operational procedures in construction camps, including exit and admission control, proper removal of sewage waters, etc.</td>
<td>Construction company</td>
<td>WSPIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
<td></td>
</tr>
<tr>
<td>Use locks and mud filters during construction works.</td>
<td>Construction company</td>
<td>WSD PIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
<td></td>
</tr>
<tr>
<td>Spillage of fuel, lubricants or other substances</td>
<td>Implement fuel, lubricants and other substance spillage control measures, including rules of proper storage and keeping of hazardous materials, such as oil, lubricants, different types of fuel, combustible and corrosive materials. Lubricants shall be stockpiled and kept in special tares and, if possible, reused or transported to the properly controlled areas. If there is a risk of spillage into the river, water sampling and testing shall be made.</td>
<td>Construction company</td>
<td>WSD PIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Temporary air pollution (dust), inconvenience from noise and vibration related to the construction materials,</td>
<td>Use closed/covered trucks for the transportation of the excavated soil, construction materials and wastes. Before leaving construction site, and depending on the season, wheels of trucks shall be washed to prevent the transportation of mud and dust onto the roads.</td>
<td>Construction company</td>
<td>WPIU, RA MNP</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
<td>Supervising Agency</td>
<td>Costs</td>
<td>Period</td>
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<tr>
<td>etc., transportation and truck movement</td>
<td>Regular checks of transport means and machinery.</td>
<td>Construction company</td>
<td>WSD PIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td></td>
<td>Transport the unnecessary materials and clean surrounding areas (after completion of works).</td>
<td>Construction company</td>
<td>WSPIU Community Administration</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td></td>
<td>Provide necessary protective outfit and accessories to the workers dealing with hazardous materials and dust.</td>
<td>Construction company</td>
<td>WSD PIU RA MoH</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td></td>
<td>Complete works at a defined time (i.e. work during the daytime), avoid increased noise.</td>
<td>Construction company</td>
<td>WSPIU</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Ensuring the safety of staff</td>
<td>When dealing with hazardous materials and using heavy equipment, the workers shall have and use the safety accessories.</td>
<td>Construction company</td>
<td>WSPIU, National Center of Technical Safety</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Impacts on historical and cultural monuments or other objects of cultural value</td>
<td>If historical and cultural monuments are discovered during earthworks, the works shall be stopped immediately and the relevant information shall be provided to the Historical and Cultural Monuments Protection State Agency.</td>
<td>Construction company</td>
<td>WSPUI RA Ministry of Culture</td>
<td>Make costs (losses) calculation in case of suspension of works</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
<td>Supervising Agency</td>
<td>Costs</td>
<td>Period</td>
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</tr>
<tr>
<td>Landscape deterioration and soil erosion</td>
<td>The fertile topsoil shall be stripped and kept for future use in reinstatement works, in accordance with the Procedure approved by the RA Government. The excavated soil and other materials shall be piled up only in specially designated areas (free from vegetative cover). Upon completion of construction works, the landscape shall be brought back/returned to its original state using the stripped topsoil.</td>
<td>Construction company</td>
<td>WSPIU, RA MNP</td>
<td>Regular costs for construction activities</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Protection of biodiversity</td>
<td>Vehicles movement in “Khosrov Forest” State Reserve is excluded. Temporary stockpiles and storage areas for wastes shall not be located in the same area. Combustible, toxic and chemical substances shall not be used. The specialists of the client and technical supervision consultants shall be completely aware of the limitations of the protection regime of the State Reserve and strictly follow it. Provide awareness of construction company staff on the protection of animal and plant species.</td>
<td>Construction company</td>
<td>WSPIU, RA MNP</td>
<td>Regular costs for construction activities and other Project costs</td>
<td>During construction activities</td>
</tr>
<tr>
<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
<td>Supervising Agency</td>
<td>Costs</td>
<td>Period</td>
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<tr>
<td></td>
<td>Strict application of all environmental fines and penalties, which are defined by the Republic of Armenia legislation</td>
<td>Construction company</td>
<td>WSPIU, State Environmental Inspectorate of the MNP</td>
<td>Regular costs for construction activities and other Project costs</td>
<td>During construction activities</td>
</tr>
</tbody>
</table>

**Operation phase**

<table>
<thead>
<tr>
<th>Damage to water ecosystem of the river Azat</th>
<th>Develop water-intake schedule and observe its indicators.</th>
<th>WUA</th>
<th>WSPIU RA MNP</th>
<th>Regular operation costs</th>
<th>In all operation phases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervise pipelines operation and control appropriate water supply to the target communities.</td>
<td>WUA</td>
<td>WSPIU</td>
<td>Regular operation costs</td>
<td>In all operation phases</td>
<td></td>
</tr>
<tr>
<td>Quick response to alarm on leakage and urgent solution to the emerged problems</td>
<td>WUA</td>
<td>WSPIU</td>
<td>Regular operation costs</td>
<td>In all operation phases</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation of losses caused to community or individuals during emergency situation</td>
<td>WUA</td>
<td>WSPIU</td>
<td>Regular operation costs</td>
<td>In all operation phases</td>
<td></td>
</tr>
<tr>
<td>Potential adverse impact</td>
<td>Environmental and social impacts mitigation or monitoring measures</td>
<td>Implementing Agency</td>
<td>Supervising Agency</td>
<td>Costs</td>
<td>Period</td>
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</tr>
<tr>
<td>Possible increase of the quantity of pesticides used</td>
<td>Organization of information campaigns together with the other teams of the projects; Periodical organization of training courses for the WUA staff and farmers on the use of pesticides; Inclusion of questions related to pesticides in the sociological surveys organized, and analysis of the results based on the responses obtained (PIU has experience in similar sociological surveys and will further develop and expand the existing surveys, to incorporate issues related to proper application and management of pesticides).</td>
<td>WUA</td>
<td>WSPIU RA MoA</td>
<td>Regular operation costs</td>
<td>In all operation phases</td>
</tr>
</tbody>
</table>
# Annex 1. B. Environmental Monitoring Plan

<table>
<thead>
<tr>
<th>Activity</th>
<th>What (is the parameter to be monitored?)</th>
<th>Where (is the parameter to be monitored?)</th>
<th>How (is the parameter to be monitored?)</th>
<th>When (define the frequency or continuous?)</th>
<th>Why (is the parameter to be monitored?)</th>
<th>Cost (of monitoring the parameter)</th>
<th>Who (is responsible for monitoring?)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DESIGN PHASE</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Ensuring accessibility of construction sites</td>
<td>Access roads present or planned for connectivity to the construction sites</td>
<td>Design documents</td>
<td>Review</td>
<td>During the design</td>
<td>Avoid ad hoc and potentially damaging access by construction contractor</td>
<td>Part of design contract</td>
<td>PIU</td>
</tr>
<tr>
<td>Providing temporary routes for cattle movement during construction</td>
<td>Temporary access routes planned for moving cattle during construction works near Garni</td>
<td>Design documents</td>
<td>Review</td>
<td>During the design</td>
<td>Avoid hindering movement of cattle or ad hoc and potentially damaging solutions by local community</td>
<td>Part of design contract</td>
<td>PIU</td>
</tr>
<tr>
<td><strong>CONSTRUCTION PHASE</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Transporting construction materials and solid waste</td>
<td>Vehicles in use in adequate technical condition</td>
<td>Between construction site and material sources Between construction site and disposal sites</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Minimize pollution and littering on and long the transportation roads Avoid excessive damage of vegetation due to unregulated movement of vehicles</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant Traffic police</td>
</tr>
<tr>
<td>Activity</td>
<td>What (is the parameter to be monitored?)</td>
<td>Where (is the parameter to be monitored?)</td>
<td>How (define the frequency or continuous?)</td>
<td>When (is the parameter to be monitored?)</td>
<td>Why (is the parameter to be monitored?)</td>
<td>Cost (of monitoring the parameter?)</td>
<td>Who (is responsible for monitoring?)</td>
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</tr>
<tr>
<td>Generation of solid waste and excess material</td>
<td>Waste and material stored in the designated on-site storage locations</td>
<td>Entire work site</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Prevent pollution and landscape degradation</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant, Municipalities</td>
</tr>
<tr>
<td></td>
<td>Timely arrangements made with municipal authority for out-transportation and disposal of the solid waste</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Permission obtained from the local authority for the disposal of excess material and confine disposal strictly to the designated sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation of liquid waste</td>
<td>Tanks for liquid waste collection provided at work sites and used for waste storage</td>
<td>Contractor's camp/base</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Prevent pollution of water and soil</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant, Municipalities</td>
</tr>
<tr>
<td></td>
<td>Tanks timely removed for the disposal of waste water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>What (is the parameter to be monitored?)</td>
<td>Where (is the parameter to be monitored?)</td>
<td>How</td>
<td>When (define the frequency or continuous?)</td>
<td>Why (is the parameter to be monitored?)</td>
<td>Cost (of monitoring the parameter)</td>
<td>Who (is responsible for monitoring?)</td>
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</tr>
<tr>
<td>Generation of hazardous waste</td>
<td>Servicing and fuelling of vehicles and machinery performed at service centres outside the construction area to the extent possible. In case of vehicle servicing performed on-site, a designated location with impermeable floor and confining walls capable of containing handled volumes of fuel.</td>
<td>Contractor's camp/base</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Prevent pollution of water and soil</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant</td>
</tr>
<tr>
<td>Operation of construction equipment and machinery</td>
<td>All equipment and machinery in adequate technical condition. Idling of engines avoided when machinery not in use.</td>
<td>Entire works site</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Minimize emissions and noise. Control nuisance to local residents</td>
<td>Included in supervision contract cost</td>
<td>Ministry of Nature Protection</td>
</tr>
</tbody>
</table>

Prevent pollution of water and soil. Included in supervision contract cost. PIU through supervision consultant.
<table>
<thead>
<tr>
<th>Activity</th>
<th>What</th>
<th>Where</th>
<th>How</th>
<th>When</th>
<th>Why</th>
<th>Cost</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works in and near the waterways</td>
<td>No entry of vehicles and machinery into the water flow construction materials, excavated soil and waste kept away from the water stream and river banks Pipeline construction works performed on the existing bridges without causing damage to the bridge structures and littering of the river bed</td>
<td>Azat river and its banks</td>
<td>Inspection</td>
<td>Entire duration of works</td>
<td>Minimize disturbance of the aquatic life prevent degradation of water quality Minimize erosion of river banks</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant Ministry of Nature Protection</td>
</tr>
<tr>
<td>Quality of water flow</td>
<td>- Oils - Suspended solids</td>
<td>Azat river</td>
<td>Laboratory testing</td>
<td>Weekly during earth works</td>
<td>Prevent pollution of water</td>
<td>120000 AMD (250 USD)</td>
<td>Environmental Impact Monitoring Centre of MNP</td>
</tr>
<tr>
<td>Activity</td>
<td>What</td>
<td>Where</td>
<td>How</td>
<td>When</td>
<td>Why</td>
<td>Cost</td>
<td>Who</td>
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</tr>
<tr>
<td>Work site reinstatement and landscape</td>
<td>Work site cleared from any residual waste and excess material upon</td>
<td>Entire work site</td>
<td>Inspection</td>
<td>Final phase of works</td>
<td>Prevent landscape degradation and loss of</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant</td>
</tr>
<tr>
<td>harmonization</td>
<td>completion of works</td>
<td></td>
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<td></td>
<td>its aesthetic appearance</td>
<td></td>
<td>Garni municipality</td>
</tr>
<tr>
<td>Labour organization and work force</td>
<td>Work site equipped with first medical aid and fire confinement took</td>
<td>Entire work site</td>
<td>Work site inspection</td>
<td>Entire duration of works</td>
<td>Protect workers’ health and safety</td>
<td>Included in supervision contract cost</td>
<td>PIU through supervision consultant</td>
</tr>
<tr>
<td>safety</td>
<td>kits</td>
<td></td>
<td>Contractor’s camp/base inspection</td>
<td></td>
<td>Minimize risks of work-site accidents</td>
<td></td>
<td>Ministry of Health</td>
</tr>
<tr>
<td></td>
<td>Personnel trained in the use of complex machinery, handling of waste,</td>
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<td>Check of contractor’s documents</td>
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<td></td>
<td>and observing safety rules</td>
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<td></td>
<td>Personnel ensured and operators of vehicles and machinery licensed</td>
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<td>for the job.</td>
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</table>

**OPERATION PHASE**
<table>
<thead>
<tr>
<th>Activity</th>
<th>What (is the parameter to be monitored?)</th>
<th>Where (is the parameter to be monitored?)</th>
<th>How (define the frequency or continuous?)</th>
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<th>Why (is the parameter to be monitored?)</th>
<th>Cost (of monitoring the parameter)</th>
<th>Who (is responsible for monitoring?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation and maintenance of Kaghtsrashen irrigation scheme</td>
<td>Water intake metered to ensure maintenance of the established ecologic water flow in the river bed, under which the aquatic ecosystem already has functioned normally</td>
<td>Water intake structures</td>
<td>Control of water intake data</td>
<td>During irrigation seasons</td>
<td>Avoid damage to the river ecosystem</td>
<td>To be included in the scheme annual operation budget</td>
<td>WSA WUA</td>
</tr>
<tr>
<td>Irrigation water quality and the quality of irrigated soil tracked</td>
<td>National database for the state of environment</td>
<td>Checks of the publicly available information on the water and soil quality</td>
<td>Entire period of scheme operation</td>
<td>Prevent pollution of agricultural fields, damage to the food quality and human health</td>
<td>No extra cost</td>
<td>WSA WUA</td>
<td></td>
</tr>
<tr>
<td>Information campaign on pest and pesticide management</td>
<td>Information and knowledge on the pest and pesticide management and IPM disseminated to the water users; Assessment of pest management gaps through the surveys and development of options to solve the issues</td>
<td>WUA office Water user communities</td>
<td>Check of information campaign programs and their implementation Communication with beneficiary communities</td>
<td>Entire period of scheme operation</td>
<td>Prevent negative impacts from increased pesticide use in the areas serviced by Kaghtsrashen irrigation scheme</td>
<td>To be included in the WUA annual operation budget</td>
<td>WSA</td>
</tr>
</tbody>
</table>
# Annex 2. Public Consultations

## A. MINUTES

of Public Consultation on Kaghtsrashen Gravity Irrigation Scheme

IREP/AF/QC IREP/AF/QCBS/SW-11/003

### Ararat Municipality 25.11.2014 14:00

### Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruben Abrahamyan</td>
<td>Ararat Marzpet (Governor)</td>
</tr>
<tr>
<td>Feliks Melikyan</td>
<td>PIU Acting Director</td>
</tr>
<tr>
<td>Hamlet Harutyunyan</td>
<td>PIU Engineer</td>
</tr>
<tr>
<td>Tigran Ishkhanyan</td>
<td>PIU Support Team Coordinator</td>
</tr>
<tr>
<td>Marine Vardanyan</td>
<td>PIU Social Specialist</td>
</tr>
<tr>
<td>Martiros Nalbandyan</td>
<td>PIU Environmental Specialist</td>
</tr>
<tr>
<td>Artush Sargsjan</td>
<td>Norashen Mayor</td>
</tr>
<tr>
<td>Yurik Muradyan</td>
<td>Deghdzut Mayor</td>
</tr>
<tr>
<td>Lyudmila Petrova</td>
<td>Verin Dvin Mayor</td>
</tr>
<tr>
<td>Artsrun Abrahamyan</td>
<td>Nerkin Dvin Mayor</td>
</tr>
<tr>
<td>Sokrat Hovsepyan</td>
<td>Aygesyan Mayor</td>
</tr>
<tr>
<td>Albert Saroyan</td>
<td>Vedi</td>
</tr>
<tr>
<td>Hrahat Avetisyan</td>
<td>Getazat</td>
</tr>
<tr>
<td>Marat Poghosyan</td>
<td>Hnaberd Mayor</td>
</tr>
<tr>
<td>Vram Tevosyan</td>
<td>Environmental Specialist</td>
</tr>
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<td>Mushegh Ohanyan</td>
<td>Engineer</td>
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<td>Gevorg Gabrielyan</td>
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<td>Lilia Musaelyan</td>
<td>Environmental Specialist</td>
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<td>Vardan Movsisyan</td>
<td>Masis WUA Director</td>
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<td>Martik Arakelyan</td>
<td>Vedi WUA Director</td>
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<td>Meruzhan Asatryan</td>
<td>Yerevan WUA Director</td>
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<td>Khachik Harutyunyan</td>
<td>Ararat WUA Director</td>
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<td>Arman Grigoryan</td>
<td>Azat WUA Director</td>
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<td>Aspram Babayan</td>
<td>Media Department, Ararat Municipality</td>
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<td>Kristine Khachatryan</td>
<td>Media Department, Ararat Municipality</td>
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### Subject

Public outreach on Kaghtsrashen Gravity Scheme draft design and related environmental and social issues

### Speeches
1. Ruben Abrahamyan

The Governor greeted the participants and talked about the importance of Kaghtsrashen Gravity Irrigation Scheme for social-economic development of communities. He also expressed his readiness and support to solve emerging problems.

2. Feliks Melikyan

He presented the current and future projects of Water Sector Project Implementation Unit. He noted that the current World Bank funded Irrigation System Enhancement Project under which Kaghtsrashen gravity irrigation scheme is implemented will be followed by Eurasian Development Bank funded Irrigation System Modernization Project under which secondary and tertiary networks of communities will be rehabilitated based on priorities.

3. Vram Tevosyan

He presented the draft design of the gravity irrigation scheme. He highlighted the requirements of the RA Law on Environmental Impact Assessment Expertise as well as Aarhus Convention that strictly recommend organization of public consultations. WB funded projects should pass a few phases of public consultations with participation of NGOs, representatives of local governments and public. The objective of discussions is to enable public to express their opinion before the design is finalized. He spoke about the possible environmental and social. He said that the construction of water intake structure could influence on the river bed and ecosystem, thus, a series of environmental measures were developed to possibly mitigate the impact. There might also be environmental impact during the construction of the pipeline, however, the significance of the impact will be less. He also added the pipeline would have length of 27.5km and diameter wider than 300mm the project should pass EIA expertise under Category C. This category implies insignificant impact. There might be environmental problems during the pipeline construction. The pipeline will have some impact on plants, upper layer of soil although biodiversity is not very rich in this area. He also talked about social problems noting that according to WB guidelines the private losses caused by the project should be compensated. So the working group studied the route of the pipeline to identify the households/plots that might have losses. If the pipeline route is across any private land the contractor should immediately undertake actions to develop RAP and compensate the loss. The project includes all the required actions, assessment forms, financial calculations described in RFP and to be used during RAP development. The consultant also talked about the risks at the operation phase, such as the violation of the river water balance. The water intake from the river violates the water balance in the river having some impact on the ecosystem and environment. Therefore the minimum environmental flow which is 850l/s should be kept. The environmental flow should be kept regardless of water demand so the head structure should be designed respectively to ensure the environmental flow. This requirement is strictly defined by the RA Legislation and WB.

4. Question – Are there endemic kinds of animals or plants in Garni gorge that can be eliminated?
5. Vram Tevosyan – Our team implemented studies of the area, compared the local flora and the animal world with the Red book. There are no endemic plants or animals in the pipeline area. However, Khosrov National Reserve is near and it is rich with such species. The Contractor should undertake strict measures not to harm the endemic species.

6. Question – Won’t the construction of reservoir harm the river? As we know the level of water is low in July-August.
7. Vram Tevosyan – There won’t be any reservoir construction. It will be a water intake structure built so as to keep 850l/s water in the river regardless of anything.
8. Question – How will Azat reservoir be filled?
9. Vram Tevosyan – The pumping station would take the same amount of water in the past. The water intake structure will take the same amount of water so the water balance will not be changed.
10. Marine Vardanyan
She noted that social issues are very important for the WB and are not neglected by PIU. As Garni is negatively affected community, the Consultant conducted thorough studies in the gorge so as the land owners will not suffer from the project. She also added that at that stage the Consultant was clarifying the type of land ownership through cadastral maps of Ararat marz communities and if the pipeline should cross any private land, the Consultant would start negotiating with the owner about their consent for land use and development of a RAP. She added that the project design avoids crossing private lands, however, nothing should be excluded and during the construction phase there might be emergency situations. The communities should be informed about the grievance redress mechanisms so as to appeal with their complaints/grievances to the Construction Company or the WSPIU.

At the end of public consultation meeting the participants thanked for the project that will promote agriculture development in their communities.
B. MINUTES
of Public Consultation on Kaghtsrashen Gravity Irrigation Scheme
IREP/AF/QC IREP/AF/QCBS/SW-11/003

Garni Cultural Center 10.12.2014
14:00

Participants
Ashot Vardanyan Garni Community Leader
Hamlet Harutyunyan WSPIU Engineer
Margarit Sargsyan Communication Specialist
Marine Vardanyan WSPIU Social Specialist
Martiros Nalbandyan WSPIU Environmental Specialist
Vram Tevosyan Environmental Specialist
Mesrop Khachatryan Geologist
Lilia Musaelyan Environmental Specialist
Volodya Hovhannisyan Garni Deputy Community Leader
Arusyak Ayvazyan Garni inhabitant

About 150-200 inhabitants of Garni participated in the meeting

Subject Public outreach on Kaghtsrashen Gravity Scheme draft design and related environmental and social issues

Speeches

1. Ashot Vardanyan
The Village Mayor said there were talks about the design of Kaghtsrashen gravity irrigation scheme for several months and he had studied the design. “Armhydroenergyprojekt” CSC won the tender to develop the gravity scheme design which will solve the gravity irrigation issue of about 500-600ha lands in 10-12 communities. He admitted the significance of this project with which the communities would no longer use the pumping station. He also added that some areas in their community had turned into desert. In July-August the community has 400-500l of irrigation water. Recent years are low-water years and they are unable to irrigate about 800-900ha of lands. In July and August they need additional 350-400l of water for irrigation. He added should their community be supplied with water they wouldn’t oppose to the construction of the gravity irrigation scheme. He noted that apart from that scheme there was another scheme design which would raise the dam of Geghardalich reservoir and a plan to build another reservoir. The route of the pipeline supplying water to several communities is through upper wastelands. With the mediation of the communities’ leaders the consulting company is presently developing a new design which will pass through their community and will give them opportunity to irrigate extra 150ha of lands with gravity which are now irrigated through pumping station and consuming energy of 30 million AMD. After having this problem solved they will also think about finding some solution for their deserted lands in the reservoir vicinity.

Some of the participants were concerned about Geghardalich reservoir capacity. It is not filled to its full capacity so it cannot meet the demand of the communities.
2. Hamlet Harutyunyan

He tried to clarify the information about Geghardalich gravity irrigation scheme given by the mayor and he added that the upcoming Irrigation System Modernization Project will include rehabilitation of Garni canals. He also explained which sources Geghardalich reservoir and the planned new reservoir could be filled with.

The participants were unwilling to discuss the project. They disturbed the meeting with rude expressions and shouts.

The village mayor’s office did not organize the event properly and didn’t ensure conditions for the Consultant to present and discuss the project and to get feedback from the community.

Garni community is not ready to discuss gravity irrigation scheme design which will supply other communities with irrigation water. The River Azat starting at other communities flows through the gorge and the community are unable to use the water to irrigate their lands in the highlands apart from a few landowners in the gorge who use the river water and may get water from the gravity scheme. At the same time the community are doubtful about environmental flow, they think the river will dry out and the gorge will lose its attraction. But they do not want to hear replies and explanations to their concerns.
C. MINUTES

of Public Consultation on Environmental and Social Issues of Kaghtsrashen Gravity Irrigation Scheme

IREP/AF/QC IREP/AF/QCBS/SW-11/003

Garni Municipality 18.02.2015

12:00

Participants

Ashot Vardanyan Garni Village Mayor
Tereza Petrosyan Principal of Garni High School #2
Samvel Karapetyan PIU Engineer
Marine Vardanyan PIU Social Specialist
Martiros Nalbandyan PIU Environmental Specialist
Vahagn Tonoyan Water Resources Specialist
Rustam Shahinyan PIU Water Management Specialist
Hasmik Palanjyan Armhydroenergoprojekt CSJC Chief Engineer
Levon Manukyan Garni inhabitant, teacher of physics
Volodya Hovhannisyan Garni Deputy Village Mayor
Arusyak Ayvazyan Garni inhabitant
Grigor Grigoryan Garni inhabitant
Sara Petrosyan Reporter from newspaper “Hetq”

There were about 25-30 Garni inhabitants participating in the meeting who refused to register.

DISCUSSION INITIATOR: Garni Municipality

TOPIC: Environmental and Social Impact Related to Kaghtsrashen Gravity Irrigation Scheme Design

Speeches / Presentations

Ashot Vardanyan

He presented the main objectives of Kaghtsrashen Gravity Irrigation Scheme construction: to provide gravity irrigation water from Garni gorge (the area below Garni temple) to 12 communities of Ararat Marz which are currently on pumping irrigation from Kaghtsrashen pumping station consuming energy of about 1 million USD per year. He noted that there are 28 land users in the gorge and there are gardens in the highlands which are drying out. The community has about 1,000 ha arable land which is impossible to irrigate with 400-500l/s water in July-August. He added water from that section of the river is unreachable to their community but he requested to provide their community with water as well. He expressed his concern that water would not be sufficient for Garni community and the gravity scheme so he proposed to add their water amount by bringing Baiburd stream to their canal with a pipe.

Participant – Baiburd stream flows through Khosrov National Reserve where construction works are prohibited.

Ashot Vardanyan – He presented all possible sources that can fill Geghardalich reservoir and noted that Geghardalich 2 reservoir would be impossible to fill with Gilanlar stream.

Hasmik Palanjyan – She asked to discuss only Kaghtsrashen Scheme.

Hasmik Palanjyan – She explained that environmental flow will be ensured through the fish pass after which the required amount of water for irrigation will be collected.

Grigor Grigoryan – He expressed his suspicion about the preciseness of hydrological data which do not reflect actual situation.

Vahagn Tonoyan – He noted that according to the matrix hydrological data distributed per months the water amount in the river is sufficient for both environmental flow and gravity scheme.

Grigor Grigoryan was sure that the water data are not trustworthy as there are no water meters.
Ashot Vardanyan noted that water quantity is sufficient due to the fact that Yerevanjur (Yerevan Water) takes less water currently compared with the past and the situation might change if there is repatriation of emigrants.  

Arusyak Ayvazyan – She suggested finding alternative ways, for instance building wind stations to produce cheap energy.  

Tereza Petrosyan – She suggested taking water to Kaghtsrashen with a pipeline from the reservoir.  

Hasmik Palanjyan explained that taking water to Kaghtsrashen from reservoir by gravity is impossible. She also explained that the communities will receive water through a closed pipeline which unlike open canals excludes water loss on the way, thus, thus ensuring water economy apart from energy economy.  

Tereza Petrosyan – She expressed her opinion that Ararat Marz communities will be supplied with Garni water but nothing is done for Garni community.  

Martiros Nalbandyan noted that there are upcoming projects about which the team will be talking to the participants.  

Sara Petrosyan (reporter from “Hetq”) – She noted that the aim of the gravity scheme is to provide 2 communities – Narek and Kaghtsrashen - with irrigation water. She also added it would be better to allocate the funds to renovation of the reservoir which is in emergency state.  

Marine Vardanyan noted that the number of affected communities is 12. She wondered how the reporter would respond to the irrigation water demand of the affected communities in summer if the pumping station which is in emergency state would not be able to pump water to the communities.  

Sara Petrosyan (reporter from “Hetq”) was interested what the base, the purpose of the discussion was.  

Martiros Nalbandyan explained that the meeting was initiated by Garni community and the community leader to present the gravity scheme once again and to inform the community of upcoming project of irrigation system rehabilitation in Garni community. He particularly emphasized all the upcoming plans for the system improvements which will result in irrigation water quantity increase.  

Samvel Karapetyan clarified that the information about emergency state of the reservoir is not realistic.  

Ashot Vardanyan confirmed the readiness to give agreement as the project will stop the operation of the pumping station. He requested to solve their irrigation water demand as well.  

Several community members opposed to taking water from the river Azat. Several others talked about the existing shortage in their community.  

Afterwards, the participants gave interviews to the media representatives expressing their viewpoints.
D. MINUTES  
of Attempted Public Consultation on Kaghtsrashen Gravity Irrigation Scheme  
Environmental and Social Impact Assessment draft report  
RA Kotayq Marz, Garni Community, Culture House  
December 21, 2015, 11:00am  

Public Notification  

Announcement on Public Consultation  
The notification on a public consultation was published in the national daily newspaper “Hayastani Hanrapetutyun” (Republic of Armenia) on 11.12.2015. The notification included information about the objective, time and venue of the consultation, as well as the link to the ESIA draft report posted on the WSPIU website (the scanned notification is attached, Attachment 1). The announcement on the public consultation time and venue was sent to the Garni municipality to be posted at a public place. WSPIU was regularly monitoring that announcements posted are in place in Garni community. The photos taken on December 11 and 17 are attached (Attachment 2).  

ESIA Disclosure  
The ESIA draft report for construction of Kaghtsrashen gravity irrigation scheme is posted on the WSPIU website (piu.am→safeguards). The hard copies of the ESIA draft report were delivered to municipalities of all affected communities in October and December 2015. It was once again electronically sent to the municipalities of the affected communities together with the announcement on the public consultation.  

Conditions of Public Consultation  
The public consultation was planned to be held in the Culture House of Garni community. The hall has enough seats and it is convenient for organization and implementation of a public consultation. In order to more efficiently disseminate the project information the WB and WSPIU staff had previously organized and conducted FG discussions with the community members. At the same time the team had developed, printed and disseminated FAQ leaflets, brochures on the project as well as posted posters in public places on this and other projects that will be implemented in Garni community. The PIU had prepared a PPT presentation, a flip chart for additional explanation; maps of Kaghtsrashen scheme and other gravity schemes, additional posters and a cadastral map with the names of land owners, whose property is not expected to be affected but is in close proximity to the projected construction. The PIU had also planned to prepare the video recording of the consultation.  

Note:  
The PIU representatives started from Yerevan at 10.00 am to reach Garni on time and to conduct the public consultation at the previously announced time. At around 10:20 am the organizers of the public consultation (Tigran Ishkhanyan, Marine Vardanyan, Martiros Nalbandyan, Margarit Sargsyan, and the operator) were on the way to Garni at Jrvezh administrative area, when several Garni community members, who were interested in the public consultation implementation to discuss the project details, called Tigran Ishkhanyan and informed him that some individuals, who are against the project, had closed the highway Garni-Yerevan. As a result there was a gathering of people (mostly drivers and passengers travelling to/from Yerevan). They also noted that it would not be possible to reach the Culture house and to conduct the planned public consultation as the initiators try to raise an aggressive mood. In order to understand the situation better the PIU staff called Vahagn Tonoyan (a short-term consultant of the WB) who had arrived in Garni community earlier. He described the same situation. Half an hour later the PIU staff learnt from the community members that the situation did not change and the highway was closed because of the accumulated passengers and cars. To avoid further tension and possible conflict the organizers of the public consultation decided to return to Yerevan previously informing the leader and some members of
Garni community, who support implementation of the project. The picture of the site is attached (Attachment 3).

**Conclusion**

The public consultation did not take place on Dec 21 in Garni community due to road blockage by some individuals from Garni community.
Attachment 1. Public Consultation Announcement
Attachment 2. Pictures of the Announcement Monitoring in Garni Community
Attachment 3. The picture of the initiation to prevent the public consultation
E. MINUTES
of Public Consultation on Kaghtsrashen Gravity Irrigation Scheme
Environment and Social Impact Assessment draft report
“Armhydroenergyproject” CSC, Yerevan
January 22, 2016

Public Notification

Announcement on Public Consultation
The notification on a public consultation was published in the national daily newspaper “Hayastani Hanrapetutyun” (Republic of Armenia) on 12.01.2016. The notification included information about the objective, time and venue of the consultation, as well as the link to the ESIA draft report posted on the WSPIU website (the picture of the notification is attached, Attachment 1). The announcement on the public consultation time and venue was sent to the municipalities of Garni, Lanjazat and 12 other affected communities of Ararat Marz to be posted at a public place. The WSPIU was regularly monitoring the announcements posted in the communities. The respective photos are attached (Attachment 2). Given the fact that the public consultation had to be held in Yerevan, the WSPIU organized free transportation for interested people from all affected communities. The announcement on public consultation also included information on the time and place for transportation. All interested people had an opportunity to reach Yerevan by the vehicles arranged by WSPIU at the announced time.

ESIA Disclosure
The ESIA draft report for construction of the Kaghtsrashen gravity irrigation scheme is posted in WSPIU website (piu.am→safeguards). The hard copies of the ESIA draft report were delivered to municipalities of all affected communities in October and December 2015.
Two weeks in advance of the consultation the ESIA draft report was once again electronically sent to the municipalities of the affected communities together with the announcement on the public consultation.

Conditions of Public Consultation
The public consultation was held at the office of the design consultant (“Armhydroenergyproject” CSC).
In order to present the information more efficiently the organizers furnished the meeting room with a projector for PPT presentation (Attachment 5), a flip chart for additional explanation; they also had a poster of the Kaghtsrashen scheme and other gravity schemes, posters and a cadastral map with names of the land owners listed on the walls. Copies of the FAQs on Kaghtsrashen scheme and of leaflets were made available for the public consultation participants at the meeting venue before the kick off of the consultation. These materials are now uploaded on PIU website at http://piu.am/attachfiles/2875382_245722_1.pdf
http://piu.am/attachfiles/7760947_216937_1.pdf
The pictures of the public consultation are attached (Attachment 3) and the video recording of the consultation is prepared.

Participation
There were about 120 participants in the conference room, however, 98 participants got registered (the lists of participants are attached, Attachment 4). Among the registered participants 15 were media representatives (Some links and brief summaries of publications presented in Attachment 6), 58 were from affected and stakeholder communities (20 of them were from Garni), as well as environmental activists and others. The representatives of Garni community (except the reporter from Hetq.am Sara Petrosyan who came around 10.50 am) arrived at the meeting early and they were present at the public consultation from the beginning to the end. The representatives of all stakeholder communities were also present (2-7 participants from each community).
Note
The PIU representatives arrived at the conference room at 10.00 am to prepare the room for the consultation, i.e. to install the equipment, to hang the posters, etc. The stakeholder communities representatives having arrived earlier of the announced time of the consultation (around 10:15) started to ask their questions around the posters and schemes posted on the walls. Considering the interest of the participants, as well as

(i) intentions and statements of some environmental activists expressed in social networks (e.g. Facebook) the day before (in particular, the coordinator of the Panarmenian Environmental Front disseminated the following idea in the social networks in regard with the organizations linked to the project, “All of them should be sent out of Armenia”. This claim raised some concerns and doubts that the participation of the environmental activists in the public consultation would be peaceful and constructive);

(ii) the fact of disturbing the previous public consultation by several individuals, who blocked the road to the consultation place;

the organizers of the public consultation decided to start the consultation a bit earlier than it had been planned but to continue it as long as there will be a need, so as to give opportunity to the representatives of the stakeholder communities, as the key target and engagement audience for the public consultation to ask questions and raise concerns and to receive answers and clarifications before arrival of environmental activists, with the intention/plan that the questions of the activists will be addressed too as they arrive. The PIU representatives began presenting the project and answering the questions since 10.20 (the PPT Presentation slides are attached, Attachment 5). Three representatives of Panarmenian Environmental Front, the reporter from hetq.am Sara Petrosyan as well as some media representatives joined the Consultation at about 10.50-11.15am. Most of other participants who had come earlier continued to participate in the further discussion. At 11.15 the public consultation continued and the organizers again presented the project for the participants that arrived at the announced time. All participants had an opportunity to learn the details of the project and ask their questions. The organizers of the Public Consultation presented the details of the design, the environmental and social impacts and the GRM again with the use of maps/schemes, a PPT presentation and posters. Afterwards they answered to all the concerns and questions of the participants and asked whether there are additional questions. As there were no additional questions, the Garni community members briefly presented their position. The Garni community member Grigor Grigoryan (Goqor) gave an interview to Armenia TV. The Public Consultation ended at about 12.30pm.

Presentation of the Project and ESIA
The PIU Social Specialist M. Vardanyan presented the main objective of the public consultation. Then the Chief Engineer of the project design H. Palamjyan presented the project, the implemented studies and the justification for the selection of the most optimal solution. The PIU Social Specialist M. Vardanyan presented the identified possible positive and negative social impacts of the project and the details of measures to mitigate the impacts and the Resettlement Policy Framework with PPT slides. She separately presented the Grievance Redress Mechanisms of the project and the Bank. Then she asked the PIU Environmental Specialist M. Nalbandyan to present the expected environmental impacts of the project. The PIU Environmental Specialist M. Nalbandyan presented the ESIA report. He noted that negative impact on soil resources, natural ecosystems and landscape distractions will not be significant during construction works; it is expected that during operation phase also the negative impact on water resources will not be significant because the environmental flow of 850l/sec will be maintained in the river Azat. He presented the studies conducted within the ESIA and their results as well as the respective mitigation measures.
The organizers presented the following main issues:

- The general description of the design, objectives, justifications, methods and infrastructure,
- Results of social studies,
- Possible social impacts at the construction and operation phases,
- Social impacts mitigation measures,
- Warranties for social impacts mitigation,
- The Grievance redress mechanisms,
- Results of environmental studies and the description of the environmental situation of the area,
- Possible environmental impacts at the construction and operation phases,
- Environmental impacts mitigation measures,
- The scheme ensuring the environmental flow,
- Issues related to the Natural Monuments and the «Khosrove Forest» National Reserve,
- Additional works conducted at the post-design stage including the studies to address the concerns of Garni community:

The following materials were available for the participants: ESIA report, the copies of the official letters about the social obligations of the project (from the PIU director to the Garni mayor) and about the natural monuments (from the RA Ministry of Nature Protection to SCWS), the scheme to ensure the environmental flow, the scheme of the pipeline with the names of the land owners in the gorge (whose lands are not used by the design but they are close to the project implementation area). The communication materials with the project information were distributed to the participants.

Discussion, Questions and Answers

*Question, opinion.* Albert Harutyunyan, Garni community member, a specialist of hydrotechnical structures
He mentioned that the main requirement of the Garni community is to maintain the environmental flow in the Azat River and highlighted that considering the risk of low-water years, it is important to equip and maintain Kaghtsrashen pumping station in reserve. Summarizing his speech he said that the project is acceptable and requested to remember irrigation water needs of the Garni community as well. He urged for the implementation of the Garni main canal and tertiary canals rehabilitation project.

*Reply.* Martiros Nalbandyan, PIU Environmental Specialist
He noted that the issues of mitigation of water deficit were discussed in the PIU and a decision was made to introduce drip irrigation schemes in the areas under Kaghtsrashen scheme and to rehabilitate tertiary level canals. The measures will reduce the demanded water amount. He also noted that the pumping station will be maintained with lower capacity as a reserve.

*Question, opinion.* Ashot Vardanyan, Garni community leader
He raised the issue of compensation to land owners in the gorge for private land use in case it happens. He also expressed his concerns about irrigation water demand in Garni community. Summarizing his speech he said that he does not have any objection to the project despite the above mentioned request for irrigation improvements in Garni community.

*Reply.* Martiros Nalbandyan, PIU Environmental Specialist
He informed the participants that an official guarantee letter from the WSPIU director about compensation to private owners for unforeseen damage of private property had been sent to the community leader.

*Opinion.* Khachik Hayrapetyan, Garni WUA Director
He expressed readiness to collaborate during irrigation season in water distribution issues. He also noted that August is the only challenging month, however, they will exercise mutual understanding, so no problem will emerge.

Opinion. Misak Metoyan. Artashat WUA Chief Engineer

He noted that they will try to avoid problems in future and consider the priority water use right of Garni.

Question, opinion. Garush Hakobyan, Narek community leader

He stated that currently the system and the pumping stations are depreciated so the water losses are too high. He asked to discuss the issue of upgrading the pumping station at a lower capacity and maintain it as a reserve water source.

Reply. Hasmik Palanjyan, Chief Engineer of Design

She said that the infrastructures of the pumping station, in particular the pressure pipelines, will be maintained and not dismantled as they will deliver water by gravity from the discharge boxes in a backward direction. She also added that the gravity scheme will provide as much water as currently is pumped from the Azat reservoir, however, due to reduction in water losses it will be possible to irrigate additional 387 ha.

Question, opinion. Hrayer Hakobjanyan, Lanjazat community leader

He asked about the starting date of the construction.

Reply. Martiros Nalbandyan, PIU Environmental Specialist

He answered that civil works may start immediately after a final approval of the design and expressed the hope that the construction will start in 2016.

Question, opinion. Manika Yeritsyan, reporter ecolur.org

She asked if the representatives of the World Bank participate in the meeting.

Reply. Marine Vardanyan, PIU Social Specialist

She noted that the WB representatives usually do not attend public consultations.

Question, opinion. Reporter

He stated that the Minister of Nature Protection of the RA informed recently that there were two public discussions. When did the discussions take place and how did it happen that those meetings were not attended by representatives of Garni?

Reply. Martiros Nalbandyan, PIU Environmental Specialist

He answered that discussions were organized at the design stage in accordance with the requirements of the Law of the RA on “The ESIA and Expert Examination”. According to the law the design was classified as “Class C” project which requires two public discussions. The inhabitants of Garni participated in all meetings.

Question, opinion. Reporter

She was interested to know how the initial dissatisfaction among the population of Garni community later on disappeared.

Reply. Martiros Nalbandyan, PIU Environmental Specialist

He stated that there was an intense communication with population at the post-design stage. It is connected with additional studies of the issues raised by the Garni community and a suggestion of possible solutions to them.

Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator
He stated that Azat River is the border of the Khosrov State Reserve, meantime it is stated in the Charter of the reserve that the use of water resources within the reserve area is prohibited.

_Reply. Martiros Nalbandyan, PIU Environmental Specialist_

He noted that no water intake will be implemented from the area of “Khosrov Forest” State Reserve, as the river Azat is rather the border of “Khosrov Forest” State Reserve than its area. And the project infrastructures will not cross with the borders of the Reserve anywhere.

_Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator_

He mentioned that there are four nature monuments in the gorge, which may be impacted as a result of civil works.

_Reply. Martiros Nalbandyan, PIU Environmental Specialist_

He answered that the SCWE sent an official letter to the Ministry of Nature Protection with a request to provide information on four nature monuments of the gorge. The official response stated, that they are not mapped and clarified yet. Nevertheless, the well-known natural monument Basalt Organ is 1.3 km far from the Kaghtsrashen Head Structure, which is a sufficient buffer zone. The main activities will be implemented along the road going through the gorge, which is an area included in economic activities.

_Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator_

He insisted that the design has undergone some changes after the expert examination - the designs presented in the site earlier and the one presented now differ.

_Reply. Martiros Nalbandyan, PIU Environmental Specialist_

He clarified that the Design has not been amended and the mentioned differences refer just to the narrative structure of the ESIA Report.

_Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator_

He was interested if the water uses upstream of the Kaghtsrashen headworks were taken into consideration in the environmental flow calculations.

_Reply. Martiros Nalbandyan, PIU Environmental Specialist_

He explained that all the available water uses were considered in calculation of the environmental flow and the water demand of the Kaghtsrashen scheme.

_Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator_

He expressed his doubts about the data of Hydromet and offered to conduct water measurements with the participation of all the stakeholders for at least for 3-4 years.

_Reply. Martiros Nalbandyan, PIU Environmental Specialist_

He replied that any design company relies on the official data by ARMSTATEHYDROMET. In case of Kaghtsrashen Project, in addition to the series of 60-year observations by ARMSTATEHYDROMET, additional measurements have been separately carried out during one year period involving almost all the interested parties. The results are open to the public and are posted in the official website of the WSPIU. In addition, it was suggested by the WB to have regular water measurements and made the results publicly available to the Garni community.

_Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator_
He noted that the implementation of Gegardalich project also will reduce the flow in Azat River. Meanwhile the filling of Azat Reservoir has also posed problems during the last years.

**Reply. Martiros Nalbandyan, PIU Environmental Specialist**

He explained that under the Gegardalich Project efficient water management will be implemented to gather spring flood flows of Karmir River while in spring months there is no problem with water quantity in Azat River. As for the Azat Reservoir, Kaghtsrashen scheme will take the same quantity of water, as it is released today from the Azat Reservoir through the Artashat main canal, which in case of Kaghtsrashen scheme will be delivered to the land users through gravity and not by pumps.

**Question, opinion. Levon Galstyan, Geographer, Panarmenian Environmental Protection Front, Coordinator**

He noted that about 600 ha of lands out of 1,323 ha covered by the project are located in Narek community. He was interested if Narek community was aware who the lands belong to.

**Reply. Martiros Nalbandyan, PIU Environmental Specialist**

He explained that 1,232 ha of lands included in the Project belong to over 700 households of 12 communities. And it is not so important for the Project, who are these 700 households.

**Question, opinion. Sara Petrosyan, reporter, hetq.am**

She also referred to the natural monuments and expressed an opinion that the government should firstly implement the mapping of the natural monuments of the gorge and only then carry out this project. She also proposed to use the solar energy, as pursuant to her information the economic efficiency of the project was estimated based on the energy saving indicators. She also asked about the guarantees for the maintenance of the environmental flow and a social damage compensation.

**Reply. Martiros Nalbandyan, PIU Environmental Specialist**

He informed everybody that an official written notice on social safeguards had been sent to the mayor of Garni, and the maintenance of the environmental flow is warranted by design solutions, which can be shown by the layout of the scheme, where the environmental flow release level is 50 cm less than the bottom level of the intake’s inlet. This means that minimum 850l/sec of environmental flow will be maintained.

**Question, opinion. Sara Petrosyan, reporter, hetq.am**

She noted that she had participated in the water measuring process and the deficit of August shows that the economic justifications and calculations are incomplete.

**Reply. Martiros Nalbandyan, PIU Environmental Specialist**

He stated that the economic justification of the project is based on the long-term observations data rather than on a one-year data.

**Conclusion**

Following Sara Petrosyan’s point on the four natural monuments, additional study was carried out, based on the official communication with the Ministry of Nature Protection of Armenia. As a result, a map of location of the four natural monuments has been prepared and, together with descriptive text, has been inserted in section 8.3.1 of this ESIA report (page 57).

*The community member of Garni Grigor Grigoryan (Goqor), who was a strong opponent to the Project at the initial stage, gave an interview to the media (Armenia TV channel) and noted that the Project has been clearly presented so far and, as the specialists assure that the environmental flow will be maintained, there will be no serious damages and the occurred damages will be compensated, hence, he has also changed his position and he is for the implementation of the Project. He stated that he will follow that all the promised guarantees are ensured.*
Attachment 2. Pictures of the Public Consultation Announcement Monitoring in Affected Communities
Attachment 3. Pictures of Public Consultation
## Attachment 4. List of Participants

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<thead>
<tr>
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<td>Misak Stepanyan</td>
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<td>Martiros Nalbandyan</td>
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<td>23</td>
<td>Raya Shadeyants</td>
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<td>Mariam Davtyan</td>
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<td>25</td>
<td>Armine Martirosyan</td>
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<td>26</td>
<td>Sara Petrosyan</td>
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Attachment 5. Presentation on Kagtsrashen Gravity Irrigation Scheme
Kagtsrashen Gravity Irrigation Scheme

ESIA

123
Attachment 6. Some links and brief summaries of publications

“Over 50-years old pumping station of Ararat Marz only causes troubles to villagers”. http://newspress.am/archives/17012

“The Leader of Garni Community on Kaghtsrashen Project: “Azat River will not dry up”. (video) http://menqumenq.am/%D5%A3%D5%A1%D5%BC%D5%B6%D5%B8%D6%82-%D5%A3%D5%B5%D5%B8%D6%82%D5%B2%D5%A1%D5%BA%D5%AF%D5%A8-
The topic for disagreement is the water of the Azat River, which will be used for the irrigation of 12 communities of Ararat Marz. This issue is discussed between the inhabitants of Garni, community members of Ararat Marz, Environmentalists and the SCWE representatives.

The Community Leader of Garni outlines that water is a public good and it should be delivered to the areas lacking water resources. With the WB financing the Kaghtsrashen Gravity Scheme will be constructed which will enhance the irrigation efficiency in Ararat Marz. The implementation of this project will ensure energy savings of 10 million kw/h. Pursuant to the PIU specialist Garni village with 8000 inhabitants will have no problem with irrigation water and it will suffice everybody.

The Environmentalists were concerned about the maintenance of environmental flow, as in dry years there will not be enough water in the river.

The PIU specialist stated that the water measurements were carried out during one year period, but they have analyzed the 60-year-old ecological data by ARMSTATEHYDROMET. It is certified that the water will be sufficient for the operation of Kaghtsrashen Gravity Scheme simultaneously ensuring the required environmental flow. He also outlined that everybody is aware that 2015 was an extremely dry year and the Project representatives have considered all the risks in their calculations, either.

The Kaghtsrashen pumping station will be reequipped, which will be used in peak seasons.
The Environmentalists are also concerned, that gravity system will do damage to the natural monuments “Bazalt organ” and “Khosrov Forest” State Reserve. However, PIU specialist noted that according to calculations “Bazalt organ” is 1.3 km upstream from the Head Structure.
In future it is envisaged to install drip irrigation in Ararat communities, which will reduce irrigation water consumption by 50%.

http://www.armeniatv.am/hy/55224-1453467890

In the frames of ISEP with the WB financing approximately 1200 ha of lands of Ararat Marz 12 communities will be soon irrigated by Kaghtsrashen Gravity Scheme. A dam will be constructed on the Azat river downstream Garni village and about 28 km of pipeline will be laid down. The Experts claim that the pipeline will go along the community road in the gorge without causing any damage to private lands and private resorts. This means that the operation area of Kaghtsrashen Scheme will be automatically involved in the economic activity. With the implementation of this project the tertiary irrigation network of Garni main canal and Garni gorge will be rehabilitated.

http://www.1tv.am/hy/videos/2016/01/22/%D4%B1%D5%BC%D5%A1%D5%BB%D5%AB%D5%B6-%D5%AC%D6%80%D5%A1%D5%BF%D5%BE%D5%A1%D5%AF%D5%A1%D5%B6-13-00/32026

“The Azat River will not dry up and Garni Community will not be deprived of water”.

http://www.haynews.am/hy/145357122

F. Minutes of Public Information Meeting
On
The Design Variation (relocated head structure) of the Construction of Kaghtsrashen Gravity Irrigation Scheme held on December 21, 2016 in the municipality of Garni of the RA Kotayq Region

Objective of the Meeting
Introduction of schematic posters, prepared for the Design Variations made under the compromising option of Kaghtsrashen Gravity Irrigation Scheme, to the representatives of Garni Community

Participants

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<tr>
<th>N</th>
<th>Name/Surname</th>
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<tbody>
<tr>
<td>1.</td>
<td>Martiros Nalbandyan</td>
<td>PIU Environmental Specialist</td>
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<tr>
<td>2.</td>
<td>Aharon Sahakyan</td>
<td>Mayor of Garni</td>
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<td>3.</td>
<td>Vardan Martirosyan</td>
<td>Community member</td>
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<td>Gor Vardanyan</td>
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<td>Tigran Poghosyan</td>
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<td>Saro Abelyan</td>
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<td>7.</td>
<td>Rubik Hovhannisyan</td>
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<td>8.</td>
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<td>9.</td>
<td>Samvel Karapetyan</td>
<td>PIU Engineer</td>
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The PIU Environmental Specialist Martiros Nalbandyan thanked the newly elected Mayor and the Council for expressing interest to the Kaghtsrashen Design Variation and for organising the meeting. He introduced the participants the objective of the meeting and asked the PIU Design Engineer to present the details of the Design Variation.

The PIU Design Engineer S. Karapetyan introduced the Design Variations and informed that the head intake structure of Kaghtsrashen Gravity Scheme was removed 5.2 km downstream along the Gorge to meet the demand of Garni Community. He also informed that the loss of hydraulic pressure expected from the relocation of the head structure will be compensated through a small pump station. S. Karapetyan presented the technical details of the design variation and its financial impacts.

The PIU Environmental Specialist M. Nalbandyan introduced the significant benefits and improvements of environmental situation expected from the Design Variations and carried out comparative analysis between the impacts expected from the Design Variation and the previous design. The PIU Social Specialist M. Vardanyan introduced the positive social impacts expected from the Design Variations noting that the adverse social impacts, namely impacts on tourism and small business, were minimized due to the Design Variations.

Garni Council Member S. Abelyan asked about the location, working power and capacity of the pump station mentioned in the Design Variation. The PIU Design Engineer S. Karapetyan informed that a new pump station will not be constructed and it is intended to use the building and infrastructure of Hatsavan pump station, which would be decommissioned after the operation of Geghardalich Gravity Scheme. He also noted that it is planned to have 3 pumps: 2 pumps with 400kwt and 1 pump with 500kwt of power. Moreover, only two of 3 pumps will work, the third one will be a standby pump.

Community member V. Martirosyan asked, whether a fish pass is provided on the dam of the river. The PIU Environmental Specialist M. Nalbandyan mentioned that it is intended to use the existing dam, which has a fish pass operating since the Soviet times.

Garni Council Member S. Abelyan asked, whether the Community Council provided its consent on the Design Variation. In response to it, Mayor Aharon Sahakyan reminded that the Council’s agreement was still provided at the initial stage of the Project.

Garni Council Member S. Pogosyan asked whether all the land owners of the Gorge would avoid the damages expected from civil works. The PIU Social Specialist M. Vardanyan answered that due to 5.2 km reduction of the pipeline the Project will pass by 3 potential plots, of which only one might be indirectly impacted, as it is located near the pipeline, and some small damages and temporary inconveniences may occur. However, there is a relevant agreement between the Contractor and the landowner.

Garni Community Leader A. Sahakyan asked also about the rehabilitation works of Garni Main Canal and Tertiary Network.

The PIU Environmental Specialist M. Nalbandyan informed that the design works envisaged under the Project have already been completed and after some procedures and agreements the tender for construction will commence, which will be followed by civil works.

The PIU Design Engineer S. Karapetyan presented additionally the technical and financial indicators of the rehabilitation of Garni Main Canal and Tertiary Network.

Garni Community Leader A. Sahakyan noted, that Garni Canal Rehabilitation Project is very important for their community and asked the entities responsible for the Project to inform them about the process of the Project. Simultaneously, he expressed his readiness to support in the construction works of Kaghtsrashen Gravity Scheme.

The PIU Social Specialist M. Vardanyan highlighted the role and function of GRM for the participants. She also informed that all the necessary contact details are included in the posters and the inhabitants may raise their concerns and potential problems calling by the phone number mentioned in GRM and speak directly with the people responsible for the Project.
Summarising the meeting, Garni Community Leader **A. Sahakyan** once again expressed his appreciation that Project representatives met the demand of Garni Community and removed the head intake structure 5.2 km downstream along the Gorge. He also briefly introduced the background of Kaghtsrashen Project and listed all the achievements and positive changes expected from the Design Variation of Kaghtsrashen Gravity Scheme. In the meantime, he announced on behalf of the community that the demands of Garni community were already satisfied due to the Design Variations and expressed readiness to support the implementation of Kaghtsrashen Project, within his competence.

**The schematic poster presented to the Community members**

**Photos of the Meeting**
Annex 3. Correspondence with State and Local Governance Entities and Agreements

1. Letter from “Armhydroenergyprojekt” CJSC to the RA Minister of Nature Protection

M-40 13.06.2014
To Mr. A Grigoryan
RA Minister of Nature Protection

Dear Mr. Minister,
“Armhydroenergyprojekt” CJSC is implementing the design of “Kaghtsrashen Gravity Irrigation Scheme” within “Irrigation System Enhancement Project” through a contract with Water Sector PIU.
Kaghtsrashen head water intake structure is planned to be located at mid flows of the river Azat at 1,235m mark.
We submit the plan of Kaghtsrashen Gravity Irrigation Scheme to you for your agreement.
Enclosed is the head water intake structure and the scheme plan.
Regards,
M. Khachatryan
Chief Executive Director

2. Letter from “Armhydroenergyprojekt” CJSC to Ararat Marzpet (Governor)

M-41 13.06.2014
To Mr. R. Abrahamyan
RA Ararat Governor

Dear Mr. Abrahamyan,
“Armhydroenergyprojekt” CJSC is implementing the design of “Kaghtsrashen Gravity Irrigation Scheme” within “Irrigation System Enhancement Project” through a contract with Water Sector PIU.
Kaghtsrashen head water intake structure is planned to be located at mid flows of the river Azat at 1,235m mark.
We submit the plan of Kaghtsrashen Gravity Irrigation Scheme to you for your agreement.
Enclosed is the head water intake structure and the scheme plan.
Regards,
M. Khachatryan
Chief Executive Director

3. Letter from Ararat Marzpet (Governor) to “Armhydroenergyprojekt” CJSC

REPUBLIC OF ARMENIA
ARARAT MARZPET (GOVERNOR)
To Mr. M.Khachatryan
Director of “Armhydroenergyprojekt” CSC

In response to your letter M-41 dated 13.06.14 on agreement for Kaghtsrashen Gravity Irrigation Scheme within Irrigation System Enhancement Project of WSPIU, we inform you that it has been discussed in the Department of Civil Construction and there are no objections and comments.

At the same time we would request to submit the upcoming activities plan to Ararat Municipality for agreement.

R.Abrahamyan

4. Letters from “Armhydroenergyprojekt” CJSC to 6 Community Leaders of Ararat Marz through which the pipeline will pass

A-88 20.11.2014
To Mr. G.Hakobyan
Narek Community Leader

Dear Mr. Hakobyan,

“Armhydroenergyprojekt” CJSC is implementing the design of “Kaghtsrashen Gravity Irrigation Scheme” within “Irrigation System Enhancement Project” through a contract with Water Sector PIU. The project envisions replacement of Kaghtsrashen mechanical irrigation scheme with a gravity scheme.

Replacement of the mechanical irrigation scheme with a gravity scheme helps to save the pumping station exploitation and maintenance expenses, to reduce electricity consumption and to increase water conveyance efficiency.

Through Kaghtsrashen Irrigation Gravity Scheme Artashat WUA in 12 communities of Ararat Marz can irrigate the existing arable 854ha and new 378ha of lands with the same amount of water.

The Consultant envisages to have Kaghtsrashen head water intake structure on the River Azat 9km higher than Azat reservoir in Azat Gorge on the South-East of Garni community at 1,234m mark. The required quantity of irrigation water will be conveyed through 28m pipeline to the basin of existing Kaghtsrashen pumping station with the decline of 1,235.50-1,126.80m marks.

The closed pipeline buried in the trench will pass exclusively through community or state lands avoiding private land use.

We request you to give Aygestan community agreement for the use of Aygestan community lands for the pipelines.

Enclosed is the head water intake structure and the scheme plan.

Regards,

A.Julhakyan
Chief Executive Director

The text of the letters to all communities is the same.
5. **Letter from Narek Community Leader to “Armhydroenergyprojekt” CJSC**

REPUBLIC OF ARMENIA  
ARARAT MARZ  
Narek Municipality  
To Mr. A.Julhakyan  
Director of “Armhydroenergyprojekt” CJSC  

In reply to your note A-88 dated 20.11.2014 we inform you that Narek community do not mind to Narek community land use for Kaghtsrashen gravity irrigation scheme pipeline installation.

G. Hakobyan  
Community Leader

6. **Letter from Norashen Community Leader to “Artashat” WUA**

REPUBLIC OF ARMENIA  
ARARAT MARZ  
Norashen Municipality  
To Mr. T. Tadevosyan  
Director of “Artashat” WUA  

We inform you that Norashen community have no objections to installation of the pipeline of Kaghtsrashen Gravity Irrigation Scheme through its lands.

A. Sargsyan  
Community Leader

7. **Letter from N. Dvin Community Leader to “Armhydroenergyprojekt” CJSC**

REPUBLIC OF ARMENIA  
ARARAT MARZ  
N. Dvin Municipality  
Date: 27.05.2015  

To: Mr. T. Tadevosyan  
Director of “Artashat” WUA  

We inform you that N. Dvin community have no objections to installation of the pipeline of Kaghtsrashen Gravity Irrigation Scheme through its lands.

A. Abrahamyan
8. Letter from Getazat Community Leader to “Artashat” WUA

REPUBLIC OF ARMENIA
ARARAT MARZ
Getazat Municipality
To Mr. T. Tadevosyan
Director of “Artashat” WUA

We inform you that Getazat community have no objections to installation of the pipeline of Kaghtsrashen Gravity Irrigation Scheme through its lands.
G. Harutyunyan
Community Leader

9. Letter from Verin Dvin Community Leader to “Artashat” WUA

REPUBLIC OF ARMENIA
ARARAT MARZ
Verin Dvin Municipality
To Mr. T. Tadevosyan
Director of “Artashat” WUA

We inform you that Verin Dvin community have no objections to installation of the pipeline of Kaghtsrashen Gravity Irrigation Scheme through its lands.
L. Petrova
Community Leader

10. Letter from Lanjazat Community Leader to “Armhydroenergyprojekt” CJSC

REPUBLIC OF ARMENIA
ARARAT MARZ
Lanjazat Municipality
05.02.2015
To Mr. A. Julhakyan
Director of “Armhydroenergyprojekt” CJSC
Dear Mr. Julhakyan,
In response to your note dated 30.01.2015 we inform you that the community agrees for the use of Lanjazat lands for Kaghtsrashen Gravity Irrigation Scheme.
H.Hakobjanyan
Lanjazat Community Leader

11. Letter from “Armhydroenergyprojekt” CJSC to Sevan-Hrazdan Water Intake Company

M-52 25.07.2014
To Mr. S.Harutyunyan
Sevan-Hrazdan Water Intake Company Director

“Armhydroenergyprojekt” CJSC is implementing the design of “Kaghtsrashen Gravity Irrigation Scheme” within “Irrigation System Enhancement Project” through a contract with Water Sector PIU. The project envisions replacement of Kaghtsrashen mechanical irrigation scheme with a gravity scheme.

Through Kaghtsrashen Irrigation Gravity Scheme 12 communities of Ararat Marz served by Artashat WUA can irrigate their lands.

The communities will be supplied by water directly from the river bed.

The Kaghtsrashen gravity Scheme head water intake is envisaged to be located on the River Azat 9km higher than Azat reservoir in Azat Gorge 1km downstream the reconciliation of rivers Azat and Goght at the mark of 1,230 on the South-East of Garni. The intake structure includes fish pass which implies keeping permanent environmental flow Q=0.850l³/s.

The route of pipeline starts from the head intake structure with the pipes of 800mm diameter and stretch to the end tail of Azat reservoir along the right bank of the river Azat through the trench on the left side of the ground road. Then the pipeline will continue its route along the right bank of Azat reservoir and will cross the spillway fast stream to continue along the existing ground road. No construction work will be implemented on the dam.

The pipeline is mostly burried in trench apart transition sections.

We request your agreement for the reservoir territory use for construction of Kaghtsrashen Gravity Irrigation Scheme.

Enclosed is the head water intake structure and the scheme plan.

Regards,
M.Khachatryan
Chief Executive Director

12. Letter from Sevan-Hrazdan Water Intake Company to “Armhydroenergyprojekt” CJSC

Water System State Committee
Sevan-Hrazdan Water Intake Company
04.08.2014 #377

To Mr. M. Khachatryan
Director of “Armhydroenergyprojekt” CJSC
In response to your note M-52 dated 25.07.2014 we inform you that we do not mind for Kaghtsrashen gravity irrigation scheme pipeline to pass through the reservoir nearby territory with the condition that at the section PC 144+00 – PC 152+80 the pipeline will be open over the ground.

We request you share the final solutions for that section in the working design with us.

S.Harutyunyan
Acting Director

14. Letter from Garni Community Leader (Agreement of the Community)

Republic of Armenia
Kotayk Marz, Municipality of Garni Community

23.02.2015 N01-56
Att: Mr. Julhakyan
General Director
ARMHYDROENERGOPROJEKT CJSC

Dear Mr. Julhakyan,

Garni Municipality does not mind to Garni community land use for construction of Kaghtsrashen gravity irrigation scheme in compliance with the approved plan starting from «Galactika» CSC.

A.Vardanyan
Garni Community Leader
15. Letter from “Yerevan Djur” LLC to the Director of “Armhydroenergoprojekt” CSC

Subject: Agreement on Kaghtsrashen Gravity Irrigation Scheme

Dear Mr. Julhakjan,

In response to your letter A14 dated 27.02.2015, we would like to inform you that as the width of the service road of the pressure pipeline operated by “Yerevan Jur” LLC at some sections is 6.0 – 8.0 m, we suggest to adapt the irrigation alignment with the existing one by maintaining the minimum standards of SNIP (SNIP II-89-80 and SNIP 2.07.01-89).

You can find attached the plan agreed by “Yerevan Jur” LLC.

Appendix – 1 page

Best regards,
Gor Grigoryan
Executive Director

The following resolution is written on the agreed plan:
The earthworks should be carried out with participation of the representative of ”Yerevan Djur” LLC
It is preliminary agreed.

Directorate of Water Production Safety, Health and Nature Protection
16. Decision of Garni Community Council

[LETTERHEAD OF GARNI VILLAGE COUNCIL]

DECISION
No. 15-A of special session No. 5 held on April 09, 2015
ON APPROVING THE AGENDA OF SPECIAL SESSION OF GARNI VILLAGE
COMMUNITY

According to Article 15 of the Law of the Republic of Armenia “On Local Self Government”, the Council decides:

- approve the following agenda of the special session No. 5 of the Garni Village Council of April 09, 2015.

1. On providing an agreement for laying Garni-Kahtsrashen water pipeline through the administrative area of Garni community.

    For - 6    Abstained - 0    Against - 0

    1. Saro Shahen Abelyan [Signature]
    2. Tereza Artavazd Gabrielyan [Signature]
    3. Yegiazar Grigor Bagdasaryan [Signature]
    4. Gegam Mekhak Khachatryan [Signature]
    5. Arman Karen Hovhannisyan [Signature]
    6. Ashot Makar Stepanyan [Signature]

    Community Leader [Signature] [Seal] A.Vardanyan
DECISION
No. 16-A of special session No.5 held on April 09, 2015
ON PROVIDING AN AGREEMENT FOR LAYING GARNI-KAHTSRASHEN WATER PIPELINE THROUGH THE ADMINISTRATIVE AREA OF GARNI COMMUNITY

the Council decides:

1. Agree with the placement of Garni-Kahtsrashen water pipeline through the administrative area of Garni community from “Galaktika” CJSC until Lanjazat community of Ararat Marz.

2. This decision shall enter into force from its adoption date.

For - 6  Abstained - 0  Against - 0

1. Saro Shahen Abelyan [Signature]
2. Tereza Artavazd Gabrielyan [Signature]
3. Yegiazar Grigor Bagdasaryan [Signature]
4. Gegam Mekhak Khachatryan [Signature]
5. Arman Karen Hovhannisyan [Signature]
6. Ashot Makar Stepanyan [Signature]

Community Leader [Signature] [Seal] A.Vardanyan
17. Decision of Garni Community Council (ARM)
Kaghtsaran Gravity Irrigation Scheme

ESIA
18. Agreement from “Sevan-Hrazdan Water Intake” CJSC

To: Mr. M. Khachatryan
General Director of “ArmHydroEnergy Project” CJSC

Dear Mr. Khachatryan,

In response to your letter of 25.07.2014 No M-52, we would like to inform you that we do not object the Kaghstrashen scheme pipeline to pass through the territory adjacent to Azat Reservoir.

Regards,

S. Hovhannisyan
Acting Director
ՀՆԴ 0047
ՀՀ, Երևան, ՄԻՀԷՆՆԻՐ 125
հին. 65-15-06

04.08.14 N: 377

“Զարգացման տարածքային ծրագրեր” ՓԲԸ
անդինական

օր Ո. Հայրապետյանի

Օգոստոսի 4, 2014թ.

Զարգացումը սահմանափակվում է ՓԲԸ 25.07.2014թ. թփ Ո-52 գործողությունը համարվում է, որ որում
անցնելիս Գագութերի գծավոր պահույթի արգելված բազմազան ծառայությունների համար

Զարգացման

Շիրովիկյան նախաձեռնությամբ

Ո. Հայրապետյան
19. VOLUNTARY EASEMENT AGREEMENT

v. Garni, Kotayk Marz  

Date: 29.04.2016

Entity/Citizen___________________Albik Avetisyan ____ (hereinafter the Tenant),  
(Name, surname)
Registered at the following address: v. Pakahan, Qashatagh district, RA__________  
(Registration address)
Passport: AG 0606682 issued on 22.11.2005 by 070___________________________  
(Passport (Identification Card) data)

on the one hand, and the State Agency “Water Sector Project Implementation Unit” of the State Committee of Water System of the RA Ministry of Agriculture (hereinafter “PIU”) on the other hand, and “Four Directions” LLD-“Kapavor” LLD on the third hand -signed the present Agreement on the following:

1. With this Agreement the Tenant of the Real Estate provides the PIU with the limited right of use for the Real Estate mentioned in this Agreement, particularly gives the right to move the machinery through his land during the construction works of Kaghtsrashen Gravity Irrigation Scheme.

2. The Real Estate
   a) Type: (spare/unused land near orchard)
   b) Address: Gorge of Azat River

3. The plan of the Real Estate burdened with the Easement is attached to the present Contract and makes integral part of it.

4. Objective of Providing an Easement: Movement of machinery

5. Payment for Easement: No payment is set for providing an Easement. This Easement is voluntarily provided.


7. The PIU will use the spare land for the movement of machinery and will take all possible precautions to avoid damage to adjacent land/structure/other assets and will recover the damage caused to the private property during construction works.

8. Acting Legislation of the Republic of Armenia is applied to the relations not regulated by this Contract.

9. Parties

Director of WSPIU of SCWE  
RA Ministry of Agriculture  
Felix Melikyan

Four Directions LLC-  
“Kapavor” LLC JV  
Mariam Yesayan

/Handwritten Signature/  
/Official Seal/

Owner of the Real Estate
Albik Avetisyan
Անվանական տվյալներ

քաղբուն, փոքրիկ տարածք
29-րդ ապրիլի 2016թ.

Անվան
Այլ անվանումներ (այլևս՝ «Անվանումներ»),
(անկյուն, արտաքին)

Գրավական համար
Այլ գրավական գրքեր, գրավական
(գրավական համար)

Ամսաթիվ
AG 0606682 օրվաց 22.11.2005թ. 070 կարգ
(անձառնորդ (առաջարկման արարի) տեղեկություն)

Այս դերին, Հայաստանի Հանրապետության գիտակրթական ընտրությունների և սպառնալիստական ընտրությունների համար աշխատող փոքրիկ տարածք (այլևս՝ «ՕԳ») սկզբնական ձևով ընդունված «ՕԳ» օրերի համար դատարանը (այլևս՝ «ՕԳ») սկզբնական ձևով ընդունված «ՕԳ» օրերի համար դատարանը օրերի համար պետք է սահմանեին որևէ սահման կամ գրավական գրքեր, գրավական

1. Այս հանդիպողություններ այսպիսով քաղբուն տարածքին տարածվող այսպիսով ազդեցություն ունեն, որպեսզի որպես այսպիսով տարածվող այսպիսով զգացումը գրավական գրքեր, գրավական

2. Մարդիկ գրքեր:
a) Տնօրին. (այսպիսով համարում է տարածվող այսպիսով)
b) Լուծում

3. Համաձայնագիր տարածքը. Համաձայնագիր տարածքը զգացումը այսպիսով ազդեցություն ունի տարածված պայմաններ, որպեսզի այսպիսով զգացումը գրավական գրքեր, գրավական

4. Համաձայնագիր համար. Համաձայնագիր տարածքը զգացումը այսպիսով ազդեցություն

5. Օրեկոնություն. Այս համաձայնագիրը ընդհանուր վայրի համար տարածված պայմաններ, որպեսզի այսպիսով զգացումը այսպիսով ազդեցություն

6. Համաձայնագիր. Համաձայնագիր տարածքը զգացումը այսպիսով

7. Զգացումների համար հետևանքներ։ Այսինքն համաձայնագիր

8. Միջին համակարգային շնորհավորությունից հայրենիքի համար տվող կոմբինացիան է, ինչպես նաև ինչպես, երբ տեղի է ունենում պահանջման դեպքում տեղակայված մարմարակերտ։

9. Պիեղեր

Հանրապետության տնտեսության միջազգային բաժնետոմսերի

Պետ. Սիմթիր Այփիթյան

Սիր. Սանահին Հայաստան

Միջազգային գրասենյակ անդամակցության

Պետ. Սերոս Այփիթյան

/Սանահին պաթեֆիջ/
Annex 4. Correspondence with Garni Community Leader and Other Additional Measures to Increase the Confidence

1. Letter from “Armhydroenergyprojekt” CJSC to Garni Community Leader

M-51; 15.07.2014
Att: Mr. A.Vardanyan
Governor of Garni village
Kotayk Marz, RA

Dear Mr. Vardanyan,

Armhydroenergyprojekt CJSC prepares the design for Kahtsrashen gravity irrigation scheme under the Irrigation System Enhancement Project. The Client of the assignment is the “Water Sector PIU” SA. The design is intended for conversion of Kahtsrashen pumping irrigation scheme into gravity irrigation.

The project of Kahtsrashen gravity irrigation scheme is implemented for irrigation of 12 communities of Ararat Marz located within the service area of Artashat WUA.

Irrigation demand will be supplied right from the flow of Azat River.

The intake of Kahtsrashen gravity irrigation scheme will be located in the gorge of Azat River 1 km downstream the confluence of Azat and Gogt rivers (el. 1230 m), SW from Garni village, about 9 km upstream Azat Reservoir. The intake structure includes a fish pass to ensure the mandatory, free release of the environmental flow (Q=0.85 m3/s) during the entire year.

The d=800 mm pressure irrigation pipeline will start from the intake and go through the right bank of Azat River along the left edge of the existing earth road in the gorge, until the upstream end of Azat Reservoir. The pipeline will be buried and will not harm the road. It should be noted that the pipeline will never go over cultivated lands along its entire length in the Garni Gorge.

Please provide your agreement. Thank you in advance.

Attachment: The layout of the above section of the pipeline alignment (6 sheets).

Regards,
M.Khachatryan
General Director

2. Letter from Garni community leader

25.08.2014 N01-175
“Armhydroenergyproject” CJSC
A.Julakyan
General Director
Answer to M-51 15.07.2014
Dear Mr. Julakyan,

We inform you that the issue of the construction of the Kaghtsrashen gravity irrigation system from the flow of the Azat river was discussed in the Garni village council, with the participation of the Aldermen. The public discussions took place in the hall of the Art House in Garni village, and the representatives of your company were also present.

In all discussions the people expressed a negative opinion. The problem is that many people have own lands in the canyon of Garni, which are irrigated with that water, and the construction of the waterline may desiccate their areas.

The water reserve is so little, that it doesn’t satisfy even the demands of the village.

In the south-west part of the community there are two large farms and lands of individual land owners, the total land area of which is about 350 ha of vine-yards and fruit gardens.

It is planned to construct a new gravity waterline, by the operation of which about 800 ha of lands will become irrigable.

We ask you to include the issue of the Garni gravity waterline in the mentioned project, giving preference to the Garni waterline, otherwise the community will be desiccated and will not have water reserve even for the usage of water pumps. So taking into account the public opinion we ask for pardon for not giving our agreement to the mentioned project.

A. Vardanyan
Community Leader

3. Letter from “Armhydroenergyprojekt” CJSC to Garni Community Leader

09.09.2014    A-61
To: A. Vardanyan
Garni Community Leader

Dear Mr. Vardanyan,

As an answer to your letter N 01-175, on 25.08.2014, I ask you to present the the location of the irrigated lands that are situated on lower marks than the Head structure of the Kaghtsrashen gravity irrigation system is, which is planned to implement from the flow of Azat river. I also ask to mark them on the map (as you have mentioned in your letter, those are vine-yards and fruit gardens, total 350 ha), the full names of the owners, the hectares and their permission of water usage. These data has to be presented to the Water Sector Project Implementation Unit which is implementing the Kaghtsrashen gravity irrigation System project, to the RA Government, in order to have water outlets from the penstock constructing by this project, to supply the mentioned lands with water.

We inform you that the head of the gravity irrigation system is located 1 km lower than the conjunction of the Azat and Goght rivers, in the canyon of Azat river, to the south-east from the Garni village, on the mark of 1232,5m. The penstock stretches on the right side of the river, buried under the existing road.

The layout of the area is attached.

Best regards,
A. Julakyan
4. Letter from Garni Community Leader

22.09.2014    N01-194
To: A.Julakyan
“Armhydroenergyproject” CJSC
General Director
Answer to A-61 09.09.2014

We inform you that according to the development prospective project of Garni village, the waterline is planned to construct on the mark 1350m, which is 2.8km above of the head structure of the “Kaghtsrashen gravity irrigation system”, the mark of which is 1235.5m.

The construction of the waterline on the mark suggested by us, will allow to irrigate 350 ha area of Garni lands.

By the project suggested by you these lands will not be irrigated.

That’s why we ask you to alter the project or to plan a new waterline for Garni community on the mark suggested by us.

The project layout is attached.

Garni Community Leader
A. Vardanyan

5. Letter from “Armhydroenergyprojekt” CJSC to Garni Community Leader

22/09/2014    A-65
To: A. Vardanyan
The head of the village Garni, Kotayk
Dear Mr. Vardanyan

Your answers in the letter N01-1194 on 22.09.2014 do not correspond to the questions in the letter A-61, on 09.09.2014 sent to you by “Armhydroenergyproject” CJSC, where we ask you to present:

- The location of the 350ha irrigated lands on the map, that are situated on lower marks than the head of the Kaghtsrashen gravity irrigation system is, planned from the flow of Azat river.
- The full names of the land owners and hectares, in order to present these data to the Water Sector Project Implementation Unit which is implementing the “Kaghtsrashen gravity irrigation System” project, in order to plan water outlets from the penstock constructing by this project, to supply the above mentioned lands with water.

We are not aware of the prospective project of the Garni community, but we know that there is a reconstruction project of Garni canal, which is planned to implement within the "Modernization of irrigation systems" project, financed by the Eurasian Development Bank.

Best regards,
A.Julakyan
6. Letter from “Armhydroenergyprojekt” CJSC to Garni Community Leader

A-71 23.10.2014
To Mr. A.Vardanyan
Garni Community Leader

Dear Mr. Vardanyan,

“Armhydroenergyprojekt” CJSC is implementing the design of “Kaghtsrashen Gravity Irrigation Scheme” within “Irrigation System Enhancement Project” through a contract with Water Sector PIU. The project envisions replacement of Kaghtsrashen mechanical irrigation scheme with a gravity scheme.

The Kaghtsrashen gravity Scheme head water intake is envisaged to be located on the River Azat 9km higher than Azat reservoir in Azat Gorge 1km downstream the reconciliation of rivers Azat and Goghtat the mark of 1,230.

The intake structure includes fish pass which implies keeping permanent environmental flow $Q=0.850\text{l}/s$.

The design of the pipeline route starting from the head intake structure and passing through the ground road in the gorge considers the existing communication means of the farmers alongside the road.

The design has the following solutions:

- The pipeline will stretch to the end tail of Azat reservoir along the right bank of the river Azat through the trench on the left side of the ground road,
- The pipeline avoids crossing private cultivated lands in Garni gorge,

The technologies used during the pipeline installation will allow to minimize and/or to eliminate inconveniences.

Once again we request your agreement for construction of head water intake structure and pipeline for Kaghtsrashen Gravity Irrigation Scheme.

Enclosed is the head water intake structure and the scheme plan.

Regards,
A.Julhakyan
Chief Executive Director

7. Letter from Garni Community Leader to “Armhydroenergyprojekt” CJSC

REPUBLIC OF ARMENIA
KOTAYK MARZ
Garni Municipality
To Mr. A.Julhakyan
Director of “Armhydroenergyprojekt” CJSC

In reply to your request for agreement on Kaghtsrashen gravity irrigation scheme construction through community land we would like to inform you that the pipeline will pass near private lands through the gorge.
During the construction there might be cases of causing damage to the land owners. Besides Garni community are against the pipeline and require to give solutions to irrigation problems in the community as well.

We work with the community to explain the details of the project and to mitigate the complaints.

The community have been informed that the pipeline will be laid through the community/state lands so we will give our preliminary agreement not to hinder further works.

A.Vardanyan
Community Leader

8. Letter from “Armhydroenergyprojekt” CJSC to Garni Community Leader

16.01.2015 A-3
Att: A.Vardanyan

Dear Mr. Vardanyan,

Please be informed that the design activities for Kahtsrashen gravity irrigation scheme are close to completion. During design works the representatives of our organization had several meetings-discussions with you and the population of Garni community. You have raised some issues during discussions, in particular regarding securing Garni community with additional irrigation water and improving the state of water supply. These issues were presented to the Client of the design assignment - Water Sector PIU SA of the State Committee of Water Economy of the Ministry of Agriculture of the RA with a request to raise funds and develop specific projects aimed at improving water supply of Garni community and securing it with additional water. In this regard I would like to inform you that Garni community is included into the Irrigation System Modernization Project to be implemented in the Republic of Armenia in near future. It is envisaged to invest about 500 mln AMD under that project for rehabilitation of some sections of the 8 km long main Garni pipeline and about 1,500 m of internal irrigation network. According to the data of preliminary investigations, these activities would allow to achieve about 20-25% saving of water and irrigate additional 280 ha irrigable area. Preliminary investigations were conducted by “Haygyugshinnakhagits Institute” LLC, and if you wish, you may review them in details and become acquainted with additional data.

However, please take into consideration that this proposed project for Garni community is closely linked with the construction of Kahtsrashen gravity irrigation scheme project. Considering the above, we once again ask you to give your consent for construction of Kahtsrashen gravity irrigation scheme and placement of the pipeline through the community-owned lands (mainly along the road going through the gorge), which will create an important background for the possibly earliest implementation of the above project on improving the irrigation system of Garni community.

Regards,
A.Julhakyan

9. Letter from Garni Community Leader to “Armhydroenergyprojekt” CJSC

30.01.2015 N01-34

In response to your 16.01.2015, A-3
Dear Mr. Julhakyan,

The design of Kahtsrashen gravity irrigation scheme has been introduced for public discussions in Garni community for two times. As a result, in both cases community’s population expressed negative opinion on the implementation of the said project.

Please once again organize public hearings before reaching a final solution and getting the agreement of the village municipality in order to avoid some complications during civil works.

It is also necessary to get the agreement of “Yerevan-Jur” CJSC, as the pipeline will go through the right-off area of the pipeline belonging to “Yerevan-Jur” CJSC.

A.Vardanyan
Garni Community Leader

10. Concerns raised by Garni Community and addressed by the Project.

a) Location of the head-structure

One of the initial concerns the villagers of Garni expressed was related to the selection of the location of the head-structure. Particularly, they referred to their own calculation, claiming that the head-structure can be shifted downstream, given that the pressure will be enough to supply gravity flow water to the 12 target communities of Ararat marz. Some residents felt that the gravity water could be supplied directly from Azat reservoir, given the differences in altitudes of the reservoir and target communities.

While all the engineering calculations showed the opposite, the PIU organized a joint meeting in the office of the consultant on April 21, 2015, with participation of Garni community residents, PIU engineers and the engineers of the “Armhydroenergyproject” CJSC.

The discussions in the meeting clearly demonstrated impossibility to shift the head-structure downstream because the pressure would not be enough to supply gravity flow water to the 12 target communities. In addition to this, the PIU has made a preliminary arrangement with the “Armhydroenergyproject” CJSC and Garni community concerned residents to make a field trip to the project target communities, Kaghstrashen pump station and make joint records of altitude levels with GPS and physically show the Garni resident the Kahtsrashen gravity irrigation scheme project areas.

b) Hydrological calculations and measurements

Many inhabitants of Garni questioned the validity and accuracy of data obtained from Azat-Garni hydrological observation post. According to them the calculations of water-economic balance before and after the project were not trustworthy. Some other inhabitants of Garni did not even know about the existence of hydrological post in the Garni canyon, and implied that the water-economic balance was prepared based on theoretical calculations.

In response to these concerns and in order to build a trust in hydrological data, the PIU decided to share the current flow monitoring protocol at Azat-Garni hydrological post, and organize demonstration measurements of water level and flow with participation of the residents of Garni community.

On March 22, 2015 the first demonstration measurement at Azat-Garni hydrological post was organized. The main objective of the measurement exercise was to show the representatives of Garni community how the hydrological measurements are conducted, at what frequency and how reliable the data recorded in Azat-Garni hydrological post are, based on which calculations are done for the Kaghstrashen Gravity Irrigation Scheme Project.
The inhabitants of Garni expressed continued interest in similar demonstration measurements. Hence, a second measurement exercise was organized on April 12, 2015 with participation of some other residents of Garni community, who showed interested. Based on the discussion with community residents, it was decided to continue the demonstration measurements until September, with a frequency of at least once in every month, in order to also include data from the low-flow months of summer (June, July, August).
Since May 12, 2015 the PIU water metering specialist is also conducting weekly/bi-weekly measurements of the river flow near the head-structure with participation of the concerned residents of Garni community. This activity will supplement the hydrological measurements at Azat-Garni hydrological post with another set of hydrological data and to show how compatible the results of the two measurements are.

Considering the importance of additional water measurements in Azat River implemented in 2015 within the context of increasing the confidence of the population, and taking into account the suggestions of the community population and the civil society opposing to Kaghtsrashen project to continue the water measurement activities and to involve highly qualified professionals, water measurement exercises were undertaken in 2016 by the specialists having high reputation in Armenia and deserving the confidence of the people opposing the project: the PhD of Technical Sciences, Professor of the Hydraulic Engineering, Water Systems and HPP Department of the Armenian State University of Architecture and Construction Vilik Sargsyan; PhD of Technical Sciences, Professor of the Hydraulic Engineering, Water Systems and HPP Department of the Armenian State University of Architecture and Construction Emil Khachatryan. The hydrologist of the WSPIU also participated in measurements. All the measurement records are kept at the WSPIU, and the summary results are presented in the following table.

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</table>

According to the measurement results, the minimum flow in Azat River in 2016 was observed in August and made up 1.95 m³/s. Considering the water demand of Kaghtsrashen in August (0.98 m³/s), the flow in the river will make up 0.97 m³/s, which is 0.12 m³/s higher than the estimated environmental flow for Azat River (0.85 m³/s).

c) Water quality

Another issue raised by the residents of Garni community related to quality of water in Azat River, and the fear that with the decreased river flow water quality might get worse. Though there is no surface water
Kaghtsrashen Gravity Irrigation Scheme

quality sampling point in the project section, in the downstream section at Azat Reservoir, according to 2014 data collected by the Environmental Impact Monitoring Centre (EIMC), for a broad range of water quality parameters the results show “high” or “good” status. To address the concerns of the inhabitants of Garni, the PIU has signed an agreement with the EIMC to conduct water quality monitoring in the head structure. The monitoring will include a range of 45 parameters, including basic physical-chemical parameters, heavy metals and trace elements, and organic compounds. The sampling will take place in May 2015, and interested residents of Garni community will also be invited to participate.

Parallel to this, the PIU is exploring options to add a permanent water quality sampling point of EIMC near the head structure in their annual water monitoring program of 2016 and beyond. This will provide a possibility to monitoring the water quality also over a time, when water withdrawal occurs for irrigation purposes.

d) Irrigation water deficit in Garni community

One of the main reasons of initial concern from Garni community residents on the Kaghtsrashen gravity irrigation scheme project relates to the fact that the community has an irrigation water deficit, and some agricultural lands of the community cannot be irrigated currently. While the Garni community itself cannot abstract water from the proposed head-structure to meet its own needs, the community residents felt that first their own irrigation problems should be solved, before providing gravity flow water to the 12 communities of Ararat marz.

During several public hearings and discussions the PIU specialists explained that the Kaghtsrashen gravity irrigation scheme project does not envisage any increase in the quantity of water in the Azat River and that the water anyhow goes to the above-mentioned 12 communities. What the project does is it primarily converts pump irrigation water supply to gravity supply for the 12 target communities. Thus, the project does not directly or indirectly affect the irrigation water balance of Garni community.

On the other hand, noting the irrigation water deficit in Garni community and trying to address the concern the community has, the PIU started to explore options to increase the quantity of irrigation water supply to Garni community. Analysis showed that the only optimal solution would be reduction of water losses in Garni canal (withdrawing water from the Goght River) and in the internal distribution network. Thus, the PIU has included rehabilitation of 6km critical section of Garni canal and improvement of the internal irrigation network of Garni community in the prefeasibility study of the planned Eurasian Development Bank (EDB) ISMP project. According to expert estimates, if this EDB project is implemented as planned, it will reduce irrigation water losses in Garni community by 30-40%, thus increasing the amount of water available to the community.

e) Impact on tourism

Some of the residents of Garni community have raised concerns regarding the impact of Kaghtsrashen gravity irrigation scheme on tourism in the section of the Garni canyon just below the headwork structure. While the ESIA does not indicate negative impacts on tourism in the gorge, and while some tourism potential might be created with the favorable microclimate the headwork structure will create in summer months, the PIU is exploring several options to introduce “environmental” amenities, to address the concerns of the residents. Particularly, repair of the road in the canyon and tree planting activities are being planned, to promote tourism in the canyon.

These planned environmental amenity activities will be properly communicated to the community, and at the same time PIU is open to explore additional activities, which the community residents might suggest.

f) Environmental flow and maintenance of the flow requirements

The environmental flow for Azat River in the section of the water intake of the Kaghtsrashen gravity scheme and downstream is set at 2.23 mln m³ or 0.85 m³/sec per month (according to Government of Armenia Resolution No 927 of June 30, 2011). The logic behind the Government Resolution on setting environmental flow is to ensure the well being of aquatic fauna, including fish and other aquatic species. To explain more the methodology of setting environmental flow, and how those requirements are determined and relate to the existing fauna and flora, the PIU facilitated an interview with the author of
the environmental flow methodology. The objective was to build confidence among the community members.

A very important aspect for the community is maintenance of the environmental flow. In this regard the PIU is exploring the possibility to install a SCADA system just below the head structure, which will show how much water is left at the river at all times in an on-line regime. Installation of the SCADA system will provide the opportunity to Garni inhabitants to check the water remaining in the river, and thus the compliance with the environmental flow requirements at all times. The SCADA system will provide data every 5 minutes, and also include the possibility to get reports on the river flow in the past few hours, day, week, month, quarter, and so on.
Annex 5. Environmental Expert Conclusion

I confirm,
RA Minister of Nature Protection
A. Grigoryan
23 01 2015

Environmental Expert Conclusion
EE 01

Issued: “Hayhydroenerganakhagits” CJSC
Yerevan, Moskovyan 33 a

Activity: Preliminary Environmental Impact
Assessment Request for Kaghtsrashen
Gravity Irrigation Scheme
Kotayq and Ararat RA Marzs

V. Sahakyan
Director of “Environmental Expertise” SNCO

Environmental Expert Opinion
Number EE 01

<23> 01 2015

Construction of Kaghtsrashen Gravity Irrigation Scheme

Initiator – “Hayhydroenerganakhagits” CJSC
Designer - “Hayhydroenerganakhagits” CJSC
Submitted material – Working Draft “ESIA Report on Kaghtsrashen Gravity Irrigation Scheme”
Expert – G. Chobanyan
Category of the activity – “C”
Installation site – Kotayq and Ararat Marz of RA, 13 communities

The envisaged activity request was submitted to the Environmental Expertise by “ESIA Report on Kaghtsrashen Gravity Irrigation Scheme”. “Irrigation System Enhancement Project” financed by the World Bank is addressed to the enhancement of irrigation efficiency in 12 communities under the command of “Artashat” WUA of Ararat Marz. According to the Contract signed between State Agency “Water Sector Project Implementation Unit”, “Hayhydroenerganakhagits” CJSC and “Hayjrnakhagits Institute” CJSC on 03.02.2014 the pump-based irrigation system of Kaghtsrashen must be converted into gravity-fed irrigation.
Azat River is the main source of irrigation for the surrounding lands. 854 ha of lands of Ararat Marz are currently irrigated by Kaghtsrashen-1 pumping station, which takes water from Artashat canal, Azat River (reservoir). The pumping station mentioned above utilizes 10.0 million/ kw/h of electricity and high operation costs.
Under the proposed Design it is envisaged to use the upstream natural pressure for conveying the water to the pressure basin of Kaghtsrashen pumping station ensuring the irrigation of currently
irrigated lands, as well as additionally the irrigation of 378 ha of new lands. According to the procedures stipulated in the Design, the irrigation water demand of 1232 ha of lands was estimated annually 12.03 million cubic meter or maximum 970l/sec. irrigation system efficiency -0.8. The designed irrigation system will supply water to Aygestan, Berdik, Getazat, Deghdzut, Hnaberd, Mrganush, Narek, Nergin Dvin, Norashen, Vardashen, Verin Dvin and Kaghtsrashen communities of Ararat Marz, which are located in agro climatic irrigation zone, the economy of which is mainly based on agriculture.

After the implementation of the Project Azat Reservoir will be filled by the free flow of Azat River during off-irrigation season and residual flow during irrigation season (according to hydrological observations, in case of 75% probability year (dry year) 64 Mm³ water will be accumulated in the reservoir).

During the development of the Project alternative options were observed. Economic, financial and technical as well as environmental and social factors were considered.

The designed irrigation structure comprises the head intake and the derivation. The design will utilize the water drop between 1235.5-1120.0 m in the middle stream of Azat River. Azat is a typical mountainous river. The maximum water discharge occurs in spring and summer and the minimum discharge at the end of summer and in winter. The observed average minimum discharge for the ten-days period is 0.86m³/sec according to Garni station of Azat River (1980), and it is 85m³/sec at the intake section. It is envisaged to install the intake of the designed irrigation system 1 km downstream from the confluence of Azat and Goght rivers/9km upstream from Azat reservoir/ to the south-east from Garni village.

The intake includes:

- Concrete weir of 2 m height
- Settler with intake
- Fish pass
- Water outlet-cleaner

The overall length of the pressure pipeline is 27,579 km. The derivation is envisaged to implement through a steel pipeline of d=1000, 800 and 700mm, which will be installed on the trench. The existing service roads, landowners’ cultivated plots and infrastructures have been considered for the route selection in order to avoid any kind of inconveniences. First it goes along the gorge of Azat River/ through the soft-surface of Garni Gorge/ then along the right bank of Azat Reservoir/ through the premises of the reservoir/ then it passes to the left bank crossing the spillway, Azat River and the chute and goes on up to Ararat region. Before reaching the waste basin 8 communities will be supplied with water by the required environmental flow, and Vardashen, Mrganush, Kaghtsrashen and Narek communities will be irrigated from the water basin.

The relevant agreements given by the Community leader and “Sevan-Hrazdan Water Supply Agency” CJSC (operating the reservoir) for passing the pipeline through the lands of Narek community and the adjacent areas of Azat Reservoir are available in the Design documents.

The Project structures incorporate such sections which are contiguous with “Khosrov Forest” State Reserve or are located in its protected area. According to the Design information, on the construction sites or adjacent areas there are no endemic, rare or endangered species registered in the Red book. The activities/ civil works and the operation of the system will touch upon different elements of the environment (soil, water, air/ biodiversity) as well as the affected areas and inhabitants.

As a result of Project implementation, one of the key environmental components is the maintenance of the ecosystem of Azat River. For that purpose water management calculations were carried out pursuant to the procedures set forth in the Design, where the environmental flow was estimated 0.85m³/sec. It will be released from the intake through a stepwise fish way which will ensure the free fish pass.

During the construction of the irrigation system there is a possibility of the following harmful effects: such as emissions, noise, damage to the soil, pollution of soil and water resources by the wastes and outflows generating at the construction phase. The latter may generate during earthworks as a result of
trench digging, loading and unloading of the soil, installation of wastes and operation of construction equipment. All these may have an adverse impact on the areas and the communities near the construction sites.
The following mitigating measures were proposed for avoiding or minimizing the environmental and social risks in respect with the civil works under the construction of Kaghtsrashen gravity irrigation scheme.

- Ensure non-failure and smooth operation of the machinery and equipment
- Arrange fuelling, washing and other services of construction machinery and other equipment in the service centers or other places of the site to exclude spillage of oil, lubricants into environment or water resources.
- Move the means of transport and equipment through the available or contemplated road in order to avoid causing any damage to the vegetation.
- Place the soil and topsoil separately and use it for the rehabilitation of the site and affected areas.
- Store building materials and the wastes in the site and regularly move them to the places envisaged for them. Improve and rehabilitate the used sections of the construction site in order to avoid erosion and degradation of the soil.
- Import only the construction materials proposed by certified suppliers.
- Check that all the constructors and visitors are provided with protective facilities, have relevant permit and qualification.
- Arrange the construction sites away from inhabitation and install noise dampers on the machinery.
- The Construction Company shall inform the affected inhabitants about the contemplated works in advance.

At the construction stage the water used for the household needs of the workers and construction purposes is delivered from outside. It is foreseen to install bio-toilets for the waste water in the sites. During the operation of Kaghtsrashen irrigation system the main environmental risks are related to the maintenance of the environmental flow and the ecosystem in Azat River, which can be caused in low water conditions or in case of too much intake. As mitigation measures it is envisaged to implement monitoring and constant reviews of environmental flows and intake, supervision of non-failure and capacity of the pipeline. 850l/sec of environmental flow shall be always maintained in the river regardless the flow of the river and intake necessary for irrigation.

At the construction and operation phase of Kaghtsrashen gravity irrigation system Environmental Management plan was developed for the mitigation of adverse environmental impacts and for the supervision and constant reviews of the activities. The latter incorporates information on possible risks, the list of mitigating measures for each impact, the performers and the supervision.

The submitted request includes the protocols of the public hearings held in Ararat and Kotayq regions, the prior agreements of Local Authorities and Provincial Governor of Ararat. At the expertise stage of the Preliminary Assessment Request according to the procedures stipulated in RA legislation public hearings were held in Garni community and Ararat Marzpetaran, as well. During the discussions the inhabitants of Garni community were concerned and demanded additional warrantees on the maintenance of the required environmental flow in Azat River. Simultaneously the community leader of Garni mentions that 60 ha of orchards are still deprived of irrigation. He suggests to solve the existing irrigation problems of their community.

The request was submitted to the Initiator for re-elaboration and the expert’s opinion was also considered.

Given that Ararat Marz is regarded the most intensive irrigation region, the Project implementation is of paramount importance. There will be created prerequisites for the development of agriculture in that region. It should be noted, the increase of irrigation efficiency will contribute to the reduction of O&M
Kaghtsrashen Gravity Irrigation Scheme

ESIA

costs, as well as irrigation water losses. As a result of Project implementation annually more than 10.0 million kw/h of electricity used in the pumping station will be saved, as well.

Expert Requirements

1. In order to maintain the attraction of Garni Gorge and not to endanger tourism, as well as not to damage the normal development and ecosystem of “Khosrov Forest” State Reserve (the intake is designed in the protected area) it is essential to maintain the required environmental flow of 850l/sec in Azat River regardless the flow of the river and irrigation water demand.

2. The civil works in Garni Gorge should be implemented according to the time schedule agreed with the stakeholders. After the completion of works the sites and the natural landscape should be unconditionally restored and brought to its original state.

3. In case of the detection of any species registered in the Red book in the construction sites, it is essential to follow RA Government decision N 781-N July 31, 2014. (Maintaining measures are implemented by the .......) 

4. Before the implementation of the activity it is essential:
   ➢ Obtain legal documents for corresponding land allocation of disposed lands according to stipulated procedures (change of designated purpose of land)
   ➢ Acquire relevant agreements from the community leaders for the setup of construction sites in each community, temporary storage of vegetated layer, as well as for construction waste and trash disposal sites.
   ➢ Obtain agreements for crossing areas and the premises of the reservoir, as well as for the planted tree and bush vegetation according to stipulated procedures.
   ➢ Get Water Use Permit for irrigation intake from Azat River.

Expert Opinion

Positive opinion is issued for Kaghtsrashen ESIA report submitted by “Hayhydroenerganakhagits” CJSC provided that all the expert requirements mentioned above are implemented.

Deputy Director          H. Grigoryan
Expert                           H. Mkrtchyan
Annex 6. Land ownership cadastral maps
Kaghtsrashen Gravity Irrigation Scheme

Legend

- Kaghtsrashen gravity pipeline
- Community ownership lands
- State ownership lands
- Private ownership lands

Kaghtsrashen pipeline 1st section

While it may not be clearly visible due to the scale of the map, the routing does not cross private lands (as detailed in the main ESIA text)
Kagtsrashen Gravity Irrigation Scheme

Legend
- Kagtsrashen gravity pipeline
- Community ownership lands
- State ownership lands
- Private ownership lands

Kagtsrashen pipeline 2nd section

While it may not be clearly visible due to the scale of the map, the routing does not cross private lands (as detailed in the main ESIA text)
Kaghtsrashen Gravity Irrigation Scheme

Legend
- Kaghtsrashen gravity pipeline
- Community ownership lands
- State ownership lands
- Private ownership lands

Kaghtsrashen pipeline 3rd section

While it may not be clearly visible due to the scale of the map, the routing does not cross private lands (as detailed in the main ESIA text)
Kagtsrashen pipeline 4th section

While it may not be clearly visible due to the scale of the map, the routing does not cross private lands (as detailed in the main ESIA text).
Annex 7. Hydrological data from Azat-Garni post

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Annual flow layer, mm

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</table>

Average monthly discharge, m³/sec

Average annual discharge, m³/sec

Annual flow module, l/sec km²

Annual flow layer, mm

Annual flow volume, min m²

Kaghtsrashen Gravity Irrigation Scheme

ESIA
Annex 8. Calculation basis/methods of reduced emissions due to the design variation

A. Emissions decreased due to the reduction of welding works

1260 m of welding joint will not be required as a result of the reduction of the pipeline. The quantity of electrodes used for 1260 m would make 315 kg. AHO type welding electrodes are planned for welding, and during its use emissions such as welding aerosol and manganese oxides are being generated.

The emissions from welding works are calculated in accordance with specific coefficients of the Methodological Instruction “Set of methodologies for calculation of pollutants emission into atmospheric air by different enterprises” (Goskomgidromet, Leningrad, Russia, 1986).

According to the calculations:

1. The reduced quantity of welding aerosol:

\[ 14.4 \text{ g/kg} \times 315 \text{ kg} = 4536 \text{ g or } 4.54 \text{ kg} \]

2. The reduced quantity of manganese oxides:

\[ 1.87 \text{ g/kg} \times 315 \text{ kg} = 589 \text{ g or } 0.6 \text{ kg} \]

B. Decrease of dust emissions due to the reduction of drilling, loading and unloading of soil

During drilling-loading works, dust is emitted into atmosphere. The calculations are carried out on the basis of the methodical instruction “Temporal manuals on calculating emissions from fugitive sources in the industry building materials” (Minpromstroy USSR, 1987).

The volume of soil excavation will reduce by 33 000 m³ due to the Design Variation.

The reduced emissions are calculated on the basis of the abovementioned methodology by the formula as follows:

\[ Q_1 = \left( P_1 \times P_2 \times P_3 \times P_4 \times P_5 \times G \times 10^6 \times B \times P_6 \right) / 3600 \text{ t/hour} \] (formula 1), where:

- \( P_1 \) - faction share of the dust in priming, 0.05
- \( P_2 \) - 0-50 micron size particles share in the spread of dust aerosol, 0.02
- \( P_3 \) - coefficient, which takes into account the average wind speed at the construction equipment work area, 1.0
- \( P_4 \) - coefficient, which takes into account the content of moisture in the substance, 0.6
- \( P_5 \) - coefficient, which takes into account the size of the substance, 0.2
- \( P_6 \) - coefficient, which takes into account the site conditions, 1.0
- \( B \) - coefficient, which takes into account the height of material unloading, 0.6
- \( G \) – amount of excavated soil, 33000 m³ or 85800t: 85800t per hour: 1650 hours = 52 t

\[ Q_1 = \left( 0.05 \times 0.02 \times 1.0 \times 0.6 \times 0.2 \times 52 \times 10^6 \times 0.6 \times 1.0 \right) / 3600 = 1.04 \text{ g/sec} \]

The quantity of reduced dust emission will be:
Kagtsrsashen Gravity Irrigation Scheme

1.04 g/sec x 1650 hours x 3600 sec/h : 1000000 g/t = 6.18 t

C. Decrease of dust emission from transportation of soil

During movement of vehicles, dust is emitted into atmosphere. The calculation is carried out on the basis of the methodical instruction “Temporal manuals on calculating emissions from fugitive sources in the industry building materials” (Minpromstroys USSR, 1987).

\[ Q_1 = \left( \frac{C_1 \times C_2 \times C_3 \times N \times L \times q_1 \times C_7}{3600} + C_4 \times C_5 \times C_6 \times q_2 \times F_0 \times n \right) \] (formula 2), where:
- \( C_1 \) – coefficient, considering average capacity of vehicle in site, \( C_1 = 0.8 \);
- \( C_2 \) - coefficient, considering average velocity of vehicles, \( C_2 = 2.0 \);
- \( C_3 \) - coefficient, considering conditions of roads, \( C_3 = 1.0 \);
- \( N \) – number of runs of vehicle in 1 hour, \( N = 2 \);
- \( L \) – average length of 1 run, \( L = 7 \)km;
- \( C_4 \) - coefficient, considering material profile on platform, \( C_4 \) varies within 1.3 – 1.6, \( C_4 = 1.45 \);
- \( F_0 \) – average area of platform, \( F_0 = 12 \);
- \( C_5 \) - coefficient, considering velocity of material blowing, \( C_5 = 1.0 \);
- \( C_6 \) - coefficient, considering moisture of surface layer of material, \( C_6 = 0.6 \);
- \( C_7 \) - coefficient, considering dust portion emitted into atmosphere, \( C_7 = 0.01 \);
- \( q_1 \) – dust emissions into atmosphere per 1km run, \( q_1 = 1450 \)g;
- \( q_2 \) – dust emissions from actual unit area of material, \( q_2 = 0.002 \)g/m2s;
- \( n \) – number of vehicles \( n = 2 \)

\[ Q_1 = \left( \frac{1.0 \times 2.0 \times 1.0 \times 2.0 \times 7.0 \times 1450 \times 0.6 \times 0.01}{3600} + 1.45 \times 1.0 \times 0.6 \times 0.002 \times 12 \times 2 \right) = 0.11 \) g/sec

Working hours of vehicles is 1650 hours:
\[ Q_2 = \left( 0.11 \times 1650 \times 3600 \right)/10^6 = 0.65 \) t/year

D) Diesel Fuel Combustion Outcomes

Diesel related fuel emissions are calculated on the basis of methodical instruction “Determination of hazardous substances amounts emitted from auto transportation into the atmosphere”. According to the mentioned methodology the specific emissions of heavy auto transportation and mechanical equipment are presented below in Table 1. Specific emissions (g/kg fuel):

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Name of Substance</th>
<th>CO</th>
<th>Saturated hydrocarbons</th>
<th>NOx</th>
<th>SP (solid particles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel fuel</td>
<td></td>
<td>36.4</td>
<td>8.4</td>
<td>42.4</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Taking into account that newly purchased equipment will be used, age-related parameters of park are not applied. According to design calculations, 11550 l or 9.8t of diesel fuel will be required for removing 33000 m3 soil for 7 km.
The harmful substances generated during the diesel fuel combustion are presented below in Table 2:

Table 2.

<table>
<thead>
<tr>
<th>Category of vehicle</th>
<th>Harmful substance</th>
<th>Specific emissions, g/kg (t/1000t)</th>
<th>Emissions, t</th>
</tr>
</thead>
<tbody>
<tr>
<td>High capacity vehicles</td>
<td>Carbon monoxide</td>
<td>36.4</td>
<td>0.36</td>
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<td></td>
<td>Saturated hydrocarbons</td>
<td>8.4</td>
<td>0.082</td>
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<tr>
<td></td>
<td>Nitrogen dioxide</td>
<td>42.4</td>
<td>0.42</td>
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<tr>
<td></td>
<td>Solid particles (carbon dust)</td>
<td>4.3</td>
<td>0.042</td>
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</table>

1 Vehicle Classification “Core Inventory of Air Emissions in Europe” (hereinafter CORNAIR) is applied in this method in accordance with the methodology “Atmospheric Emission Inventory Guidebook”.

Sulfur dioxide (SO₂) emissions are calculated based on the approach that the entire sulfur contained in fuel fully turns into SO₂. In this case CORINAIR inventory system formula is applied:

\[ ESO_2 = 2 \sum k_s b, \]

where:

- \( k_s \) - average content of sulfur in the fuel: 0.002t/year
- \( b \) – fuel consumption: 2091.3t/year

\[ SO_2 = 2 \times 9.8 \times 0.002 = 0.039 \text{ t} \]
Annex 9. List of References


[3] Attachment to N 430 order of the RA Minister of Environment, “List of waste classified according to the hazard”;

[4] Construction climatology CHPA II -7.01-96 (in Russian);


[7] Impact assessment procedure on atmosphere as a result of economic activity approved by the decision N-91 of RA Government on January 25, 2005;

[8] Inventory manual of atmospheric emissions. EMEP/EEA;


[13] Reserves SSR. Reserves of the Caucasus. Publisher “Misl” 1990 (in Russian);

[14] SNIP 1.02.01-85 instructions on the composition, development, coordination and approval of construction documents for the construction of enterprises, buildings and structures (in Russian);


[18] The Nature of Armenia, 2006;

