



GOVERNMENT OF THE  
REPUBLIC OF ARMENIA



GERMAN DEVELOPMENT  
BANK (THE "KfW")



GERMAN COOPERATION



EUROPEAN INVESTMENT  
BANK (THE "EIB")



EU NEIGHBORHOOD  
INVESTMENT FACILITY  
(THE "NIF")

FINANCED BY

“COMMUNAL INFRASTRUCTURE PROGRAM (CIP) II,  
PHASE 3 - ARMENIA, WATER AND SANITATION”

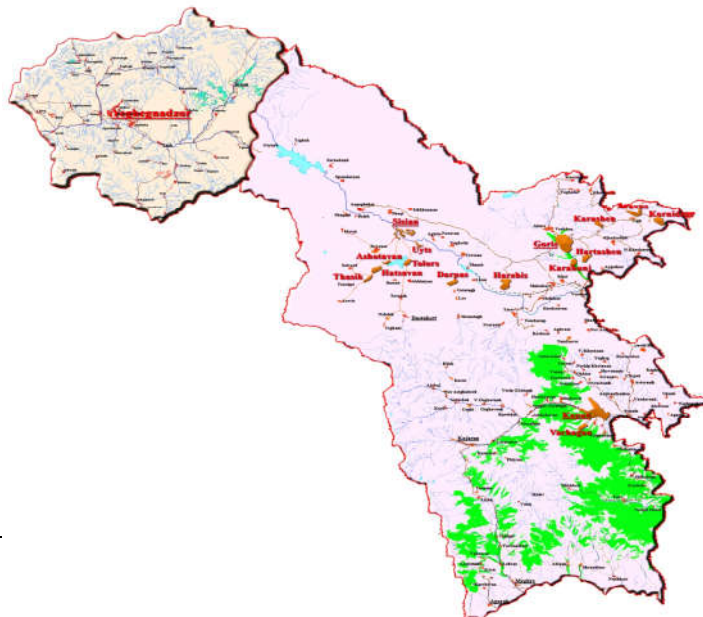
**LOT-3: DESIGN, TECHNICAL AND AUTHOR SUPERVISION OF THE WATER SUPPLY  
NETWORK AND SEWER SYSTEMS OF THE ARMENIAN WATER AND SEWERAGE  
CJSC SERVICE AREA - Contract № CIP II-P3-AWSC**

**WORKING DESIGN- FINAL (REVISED) VERSION**

## **PACKAGE 3-B. VAYOTS DZOR AND SYUNIK MARZES IN RA**

**Sub-Package 3-B-I IMPROVEMENT OF W&W SYSTEMS OF  
YEGHEGNADZOR, SISIAN TOWNS AND  
DARBAS, SHINUHAYR VILLAGES**

**Book 3-B-I.3a ENVIRONMENT AND SOCIAL  
IMPACT ASSESSMENT**



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# **PACKAGE 3-B. VAYOTS DZOR AND SYUNIK MARZES IN RA**

## **Sub-Package 3-B-I**

### **IMPROVEMENT OF W&W SYSTEMS OF YEGHEGNADZOR, SISIAN TOWNS AND DARBAS, SHINUHAYR VILLAGES**

#### **COVER OF THE DETAILED DESIGN**

- |             |                 |  |
|-------------|-----------------|--|
| <b>Book</b> | <b>3-B-I.1</b>  | <b>- GENERAL PROVISIONS</b>                        |
| <b>Book</b> | <b>3-B-I.2</b>  | <b>- TECHNICAL SPECIFICATIONS</b>                  |
| <b>Book</b> | <b>3-B-I.3a</b> | <b>- ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT</b>  |
| <b>Book</b> | <b>3-B-I.3b</b> | <b>- OCCUPATIONAL HEALTH AND SAFETY GIUDELINES</b> |
| <b>Book</b> | <b>3-B-I.4</b>  | <b>- DESIGN DRAWINGS</b>                           |
| <b>Book</b> | <b>3-B-I.5</b>  | <b>- BILL OF QUANTITIES</b>                        |
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## 1. EXECUTIVE SUMMARY

The project on “Design, Technical and Author Supervision of the Water Supply Network and Sewer Systems of the Armenian Water and Sewerage CJSC Service Area” is being implemented by the order of Water Sector Project Implementation Unit SI of SCWS, with the joint financing of the German Development bank (KfW), European Investment Bank (EIB), and EC Neighborhood Investment Facility (EC-NIF). The project is being implemented by SAFEGE SAS – JINJ LTD Consortium.

The goal of this project package is improvement of drinking water supply and wastewater systems of Yeghegnadzor town of Vayots Dzor marz, Sisian town and Darbas and Shinuhayr villages of Syunik marz.

To achieve this goal, the following is planned:

- Construction and reconstruction of headwork structures – spring intakes (Darbas).
- Construction and reconstruction of DRRs and their sanitary zones (Darbas, Shinuhayr).
- Construction of chlorination stations (Darbas).
- Construction of 18071.0 lm water mains with DN 110-250 pipes (Darbas, Shinuhayr).
- Construction, reconstruction and repair of 13.0 km water distribution networks, inlet lines of apartment buildings and private houses.
- Construction of regulating and water metering chambers (64 pcs.)
- Construction of fire hydrants (17 pcs.).
- Construction and reconstruction of sewerage network and sewage collectors of Yeghegnadzor and Sisian towns (5124 lm).

Implementation of the water and sewerage systems improvement project will allow providing safe, reliable and sustainable water supply and wastewater removal services to the consumers of the above mentioned settlements (household (about 25860 residents) and other consumers), improve public health and environment. As a result of the project the population will have an improved access to safe, reliable, and sustainable water and wastewater services and the latter will be managed on commercial principles and environmentally sound practices.

The Project will also support poverty reduction by (i) reducing the incidence of waterborne diseases and costs of medical care; (ii) improving the time poverty of women due to labor intensive housework such as water collection, which may allow them to be more engaged in social and economic activities; (iii) providing safer and more reliable water supply; and (iv) improving the quality of life of households in all the project settlements.

The results of this report will serve as a basis for mitigating / preventing negative impacts on the environment, human health and climate during the construction works for improvement of drinking water supply and wastewater systems.

The section on the environmental, social and climate impact assessment has been developed based on the screening, site studies, conversations with community leaders, and the available printed and online literature and materials.

## **2. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK**

### **2.1. POLICY AND LEGAL FRAMEWORK**

The environmental protection is enshrined in the Constitution of Armenia, Article 12 on “Preservation of the Environment and Sustainable Development”, which sets forth:

1. The public power shall promote the preservation and regeneration of the environment and the reasonable utilization of natural resources governed by the principle of sustainable development and taking into account the responsibility towards future generations.
2. Everyone shall take care of the preservation of the environment.

The environmental protection is enshrined also in the RA legislation.

#### *Law on environmental impact assessment and expertise*

The Law on environmental impact assessment and expertise was adopted on 21 of June 2014. The Law regulates the sphere of state environmental impact assessment expertise in the Republic of Armenia, including trans-boundary environment.

The law defines the main provisions and principles of assessment and expertise as well as goals and objectives. According to the legislation, the purpose of the Environmental Impact Assessment is to predict, prevent, minimize, or eliminate possible harmful effects of implementation of the baseline document and the intended activity on the environment and human health.

According to the law, 48 types of activities in more than 18 areas of public and economic life are subject to environmental impact assessment and expertise, including the construction and operation of water facilities, reservoirs and dams, embankments, large canals, pumping stations and other water management structures, any actions related to underground water extraction, reconstruction and construction of wastewater treatment plants.

Within the framework of municipal water and wastewater systems improvement projects the possible environmental impacts during construction, operation, and after decommissioning, as well as in the conditions of emergencies are estimated.

#### *The RA Law on Securing Sanitary-Epidemiological Safety of the Population*

The general requirements for the sanitary-epidemiological safety of the population in the sphere of water supply and water use are defined by the RA Law "Securing Sanitary-Epidemiological Safety of the Population of the Republic of Armenia", other laws of the Republic of Armenia, a number of governmental decisions and inter-ministerial legal acts.

The Law on Securing Sanitary-Epidemiological Safety of the Population, enforced by the State Hygiene and Anti-epidemic Inspectorate of the Ministry of Health, regulates the quality and safety of supplied drinking water.

This law defines the legal, economic and organizational aspects of the sanitary-epidemiological security of the population of the Republic of Armenia, the authorities of the State on prevention

of the impact of dangerous and harming factors of the environment on the human organism and provision of favorable conditions for the vitality of the population and the future generations.

The general requirements for the provision of sanitary-epidemiological security of the population concerning public water supply and consumption are set forth under Article 16.

Article 23 of the Law serves a basis for the mandatory sanitary-hygienic expertise, which is carried out also for the facilities with chemical and biological discharges and outflows to the environment.

The requirements for the definition and regime of sanitary protection zones are also regulated by the Land Code of the Republic of Armenia, Government Resolution № 96 of 02 February 2002, the decision No.26 of 14 January 2002.

The sanitary rules and hygienic standards are registered and enforced by the RA Law on Legal Acts.

#### Other RA Laws

The environmental impact of the works for improving water supply and wastewater systems is regulated by the RA Water Code, RA Land Code, RA Law on Specially Protected Nature Areas, other environmental laws and legal acts, as well as by the RA Labor Code.

The requirements for population health safety in water supply and water use areas are defined by the following legal acts:

Sanitary protection zones for household drinking-water, water supply and water sources No.2-III-A2-2 sanitary rules and norms, 28.12.2002, which define the sanitary-hygiene and anti-epidemiological requirements for organization and operation of sanitary protection zones for household drinking- water supply sources,

Drinking water: Requirements imposed on water quality for centralized systems. Quality enforcement sanitary rules No. 2-III-A2-1 and norms, 28.12.2002, which defines the hygiene requirements for drinking-water quality, as well as the drinking-water quality enforcement rules provided to settlements.

## **2.2. CONVENTIONS AND INTERNATIONAL TREATIES**

#### Convention on Environmental Impact Assessment in a Trans-boundary Context-Espoo, 1991).

According to the Convention, the parties undertake to mitigate, if not prevent in any way the transboundary harmful activities.

According to the Convention, the environmental impact assessment documentation shall contain the description of the proposed activity and its purpose, the reasonable alternatives to the proposed activity and also the no-action alternative, description of the environment likely to be significantly affected by the proposed activity and its alternatives, the list of mitigation measures to keep adverse environmental impact to a minimum, etc.

#### Protocol of Strategic Environmental Impact Assessment of the Convention on Environmental Impact Assessment in a Trans-boundary Context (Kiev, 2003).

The Protocol provides for Strategic environmental assessment (SEA) and the parties' commitment to this process at national and regional levels. According to the Protocol, the

programs and projects developed for the development of different sectors, and, where possible, the policy and legislation are subject to the SEA.

*Water and Health Protocol (1999) of the Convention on Protection and Use of Trans-boundary Watercourses and International Lakes, 1992*

The goals of the Protocol are to provide water quality which does not endanger human health, ensure access to drinking water for everyone, Implement sanitation and ecosystem protection measures.

*Aarhus Convention (1998)*

This Convention provides access to environmental information to the public, public participation in decision-making and access to justice for the public in the field of environmental protection. Any information about drinking water and water supply should be available to the public.

*KfW Development Bank's Environmental Policy*

The principles of the KfW Development Bank's Environmental Policy are environmental and social compatibility as well as sustainability. These principles are included in Sustainability Guideline: Assessment of Environmental, Social, and Climate Performance: Principles and Process; (April 2016).

According to the Guideline, investment projects are classified into three categories "A", "B" or "C", according to the relevance of their potentially adverse environmental and social impacts and risks.

Category A: projects that may have diverse significant adverse impacts and risks on the environment and the social conditions of the affected population. Impacts and risks may potentially be significantly adverse because the complex nature of the project measure, the scale (large to very large), the sensitivity of the location (tropical forests, coral reefs, natural protection areas, wetlands, natural/near-natural forests, important cultural heritage sites) of the measure or the impacts and risks are irreversible or unprecedented. Projects that have significant transboundary impacts or relevance with regard to international treaties, or lead to a high consumption of resources, in particular soil, land or water, are also classified to category A.

Category B includes the projects that may have potentially adverse risks and impacts upon the environment and on the social conditions of those concerned. However, the impacts and risks may have a lesser extent than these of category A measures and can usually be mitigated through state-of-the-art mitigation measures or standard solutions. Typically, the potential impacts and risks of this category measures are limited to a local area, are in most cases reversible and are easier to mitigate through appropriate measures.

For category B FC measures, the need for and the scope, the priorities and depth of an ESIA have to be determined on a case by case evaluation. If it is expected that a Category B FC measures has single significant adverse environmental and social impacts and risks, an ESMS adapted to these impacts and risks, as described under Category A, is required.

Category C includes the projects that are expected to have no or only minor adverse environmental and social impacts or risks and if the implementation and operation of the measure does not require any particular protection, compensation or monitoring measures.



However, category C measures should be monitored for any relevant changes over their life cycle.

Environmental screening has found out that in case of correct selection of the sites for the DRRs, chlorination stations, the water main routes, no irreversible negative impact is expected on landscape, flora and fauna in the area of water supply system improvement works that will be implemented in the project settlements. Besides, no adverse social and climate impact is anticipated, as a result, the project has been classified as a category B project, in accordance with KfW Guideline, Annex 1, Point 3. Use of water resources (e.g. large dams and other impoundments, pumped-storage systems/power stations, irrigation and drainage projects, deep wells, water resource management and management of catchment areas, water supply, sea water desalination plants).

### **2.3. ADMINISTRATIVE FRAMEWORK**

#### *The structure and capacities of state bodies implementing functions of water resource management and protection*

The functions of the protection, management and use of water resources in the Republic of Armenia are divided among two separate bodies.

The function of the management, maintenance and use of water systems is exercised by the State Committee of Water System (SCWS) functioning within the Ministry of Energy and Natural Resources.

The Armenian Water and Sewerage CJSC was functioning within the structure of the Committee and was operating, water and wastewater systems in 47 cities and 350 villages of the Republic of Armenia.

Yerevan Jur CJSC provided services to Yerevan and 39 adjacent settlements.

At present, one operator, "Veolia Djur" CJSC, operates in Armenia, which implements the operation of water supply and wastewater systems in 47 cities and 350 villages of Armenia.

The water resource management and protection function is currently being implemented by the Water Resources Management Agency of the Ministry of Nature Protection of the Republic of Armenia (MNP) as a separate subdivision of the RA MNP, the main functions and tasks of which are:

- Establishment and management of freshwater and groundwater resource policy for the protection and effective use of water resources of the Republic of Armenia;
- Supporting and water resources management and protection within the National Water Policy and National Water Program;
- Ensuring implementation of scientific and technical fundamental and applied researches and introduction of results in the field of water resources management and protection;
- Ensuring implementation of the results of the wastewater permissible limit discharges, in accordance with the National Water Program,
- Ensuring the development of maps of aquatic ecosystem protection zones.

Since 2003, considerable investments have been made to increase the capacity of WRMA and other subdivisions of the MNP. The USAID funded the upgrading and equipment of the

Environmental Monitoring Laboratory with modern devices and equipment. In addition, trainings for laboratory staff were held. Monitoring sites on the Hrazdan River, as well as the Republican Hydro-Meteorological and Environmental Monitoring Agency have been equipped.

The Environmental Inspection SNCO is a part of the MNP, the main function of which is to carry out environmental impact assessment expertise for activities and concepts planned in Armenia.

- Since June 2018 Health and labor Inspection body of the Republic of Armenia, HLIB has been functioning, which is a subordinate body of the Government of the Republic of Armenia exercising supervision and other functions prescribed by law and implements sanctions in the field of health care, health and safety of workers in the manner prescribed by law.

The functions of the Inspection body include:

- 1) State sanitary and anti-epidemic supervision in the territory of the Republic of Armenia provided for by the legislation of the Republic of Armenia on sanitary-epidemiological safety;
- 10) supervision of cases and procedures prescribed by law for the protection of workers' health and safety;
- 12) application of sanctions established by law for infringement of requirements of the legal acts regulating the relations in the field of health care, protection of workers' health and safety.

### 3. PROJECT DESCRIPTION

This report was developed for improvement of water supply and sewerage systems Yeghegnadzor town of Vayots Dzor marz, Sisian town and Darbas and Shinuhayr villages of Syunik marz, the design for which was implemented by SAFEGE SAS - JINJ LTD Consortium.

Rehabilitation of water supply and sewerage systems of the above mentioned settlements includes reconstruction and construction of spring intakes, DRRs, chlorination stations, reconstruction of water supply (water main and distribution network) and sewerage systems (sewerage network) and construction of new ones, construction of valve nodes and water metering chambers of private houses, construction of inspection chambers.

Adverse environmental and social impacts are possible during construction work, as well as in future operation and maintenance of water supply systems, which will be minimized or prevented due to good management. It is anticipated that adverse impacts on the environment and the social condition of the affected population will be minimal and will be of temporary nature during construction works. They can include vegetation cutting, soil erosion, air pollution, as well as pollution of soil and water resources by lubricants, chlorine compounds, household and construction waste, traffic congestion, open trench for a long time, and so on.

In the operation stage, the adverse environmental impacts may be reduced conditioned by the proper implementation of operation rules.

The most essential one among the positive environmental impacts is the protection and sustainable use of water resources.

The social and economic effects as a result of water supply and wastewater system improvement are expected to be mostly positive, such as excluding potable and irrigation water mixing with household wastewater, minimization of water and land resources pollution risk, prevention and exclusion of infection disease agents penetration into potable water, water supply extension, providing sustainable water supply and rational water use.

Below the description of possible adverse impacts and mitigation measures required during different stages of water supply and wastewater systems rehabilitation project is provided.

#### ❖ *Design stage*

The design works on water and wastewater systems have been performed by SAFEGE SAS – JINJ LTD Consortium. The design documents include articles on climatic conditions, relief, natural soil types, hydrology and vegetation, as well as the requirements on obtaining the RA MNP and other Ministries' permissions. They include also corresponding environmental and social articles. The design package includes also the ESMP of the package. The Project Consultant is in charge to follow the appropriate provisions of the RA Environmental and social legislation, as well as KfW Bank Guidelines and strategy requirements.

#### ❖ *Construction stage*

The list of measures required to mitigate the adverse environmental impact during construction stage is provided in the ESMP table.

The operation in the construction stage must be carried out in accordance with the Operation Rules and Standards.

❖ *Operation stage*

In order to minimize the impact on the environment in the operational stage it should be carried out according to the rules and norms of operation of water and wastewater systems.

## **4. SCOPE OF WORKS**

### **4.1. DESCRIPTION OF THE EXISTING SEWERAGE SYSTEM OF YEGHEGNADZOR TOWN**

Yeghegnadzor town's sewerage system is serviced by "Veolia Djur" Company. It was built in the 1960s. It is mainly made of 150-400mm ceramic, asbestos-cement and cast iron pipes. The total length of the network is approximately 20 km, of which about 0.5 km has been reconstructed in recent years using 160 mm polyethylene pipes. The wastewater network is presently in a satisfactory condition. However, wastewater is discharged in several places into small streams flowing through the town.

The town's newly constructed districts of Gladzor and Noravan do not have sewerage networks.

Gladzor district is a newly built up district with one or two storey houses. At present, residents use pit toilets.

### **4.2. DESCRIPTION OF THE EXISTING WATER SUPPLY SEWERAGE SYSTEMS OF SISIAN TOWN**

Sisian town's water and sewerage systems are serviced by "Veolia Djur" Company.

*Water supply system:* Shake spring intake located at 1700.0 absolute elevation, with the spring capacity of 300 l / sec serves a water sources for the town.

Water is supplied from Shake spring intake to Sisian town through two operating water mains, with 2 DRRs to the right bank district and without DRR to the left bank district (construction of a DRR started during Soviet times, but remained incomplete).

Disinfection of drinking water is carried out in the newly built chlorination station with chlorine tablets.

Sisian's right-bank and left-bank districts' water distribution networks are conventionally treated as two separate zones, between which there are interconnections for changing the supply directions when necessary. The main part of the distribution network was built in the 1970s; its total length is about 46 km and it is made of 50-300mm polyethylene, cast iron and steel pipes. The distribution network of the right-bank district was almost completely reconstructed under the ADB funded project in 2010-2011, while in the left-bank districts water lines of several streets have been replaced at the former AWSC's own funds in recent years (overall, about 26 km. The most part of the remaining distribution network is now almost entirely subject to reconstruction. The town has 24-hour water supply.

In the private sector's parts of the distribution network, where reconstruction works of the water lines have been carried out, individual water metering chambers of the customers have been installed with their water meters, and in other parts the individual meters are installed in customers' homes.

*Sisian town's sewerage system.* The town is fully sewered. The sewerage network is a separate system, which was built in the 1970s. It is mainly made of 150-1000mm ceramic, asbestos-cement and cast iron pipes. The total length of the network is approximately 53 km. Wastewater treatment plant construction work was launched during the Soviet times, but it remained incomplete. A 1000 mm r / c sewer collector was built up to the treatment plant. This collector is currently not fully operated. The wastewater is discharged into the river Vorotan in different parts of the town.

There were no investments made in the sewerage system, therefore there are many accidents and clogging in the network.

### **4.3. DESCRIPTION OF THE WATER SUPPLY SYSTEMS OF DARBAS AND SHINUHAYR VILLAGES**

#### **4.3.1. Water supply system of Darbas village**

Water supply to Darbas village is carried out from two underground captured water springs, located in Shenatagh village administrative area.

The captured spring called "Saghkarsu" was built in 1969 and is located at 2441 m absolute elevation. It operates but needs reconstruction. The spring flow has seasonal fluctuations within a range of 2-5 l/s. The spring has no sanitary protection zone.

The captured spring called "Yot aghbyur" is located in the area called "Tvakar", at 2836 m absolute elevation. This spring was captured in 2008 and is currently in a poor state and is not operated. It needs reconstruction. The main reason, for which the spring is not operated is the lack of water main, which has been damaged during the floods. The flow of this spring too has seasonal fluctuations within a range of 3-10 l/s.

From the "Saghkarsu" springs to Darbas village's existing DRR a water main was constructed in 1969; it is 12 km long and is made of 80-125mm steel pipes.

"Yot aghbyur" water main has 3.7 km length; it was built in 2008, made of 100-150 mm polyethylene and steel pipes. At its end part it joins with the "Saghkarsu" water main. These mains have numerous emergency segments.

The existing DRR of the village, which was built in 1989, is not located at the dominant position over the whole village. It is in emergency condition and there are leaks from the DRR. The DRR does not have a sanitary protection zone.

The 2.5 km long distribution network was mainly reconstructed in 2006, made of 50-100mm steel pipes. The reconstruction work was carried out with big violations of norms: used pipes were applied, as a result of which the distribution network is in poor condition and is currently subject to full replacement. The water supply is carried 24-hours a day. The residents do not have individual meters. The customers are not charged for water supply.

The system operation is carried out by the local government.

#### 4.3.2. Water supply system of Shinuhayr village

Water is supplied to Shinuhayr village directly from the valve chamber constructed on Mukhuturyan-Goris-Kornidzor water main, from which also Khot village is supplied through a separate water main. The cover of the valve node is almost fully deteriorated and the chamber is almost fully filled with soil and waste. There is a water metering chamber at about 7m distance from the mentioned chamber, where the water meters of Shinuhayr and Khot villages are installed. The chamber is in normal condition, however the valves, water meters and fittings in the chamber are subject to replacement.

In the south-western part of the village a 250m<sup>3</sup> capacity DRR was constructed in the 1960s. at 1602 m absolute elevation. It has not been operating for almost 40 years (it is not suitable for renovation and further operation) and the distribution network is supplied directly from the water main.

The main part of the distribution network was built in the 1960s with 100-150 mm steel and cast iron pipes. Presently it is in emergency condition, there are considerable leaks. In recent years, at the expense of the former AWSC nearly 1.5km long water pipes were replaced with 63-90mm diameter polyethylene pipes. In the sections of the replaced water lines of the distribution network, polymer-sand water meter chambers are installed on the inlets of individual houses. Water meters of the consumers in the other parts of the village are installed in homes. Disinfection of the water supplied to Shinuhayr village is not currently implemented. The system is serviced by “Veolia Djur” Company.

#### 4.4. DESCRIPTION OF THE PROPOSED REHABILITATION WORKS

In Yeghegnadzor town, within the framework of this project Gladzor district’s internal sewerage network is to be constructed, connecting it with the operating sewerage network of the town.

Under the DD, construction of sewer collectors conventionally numbered C<sub>1</sub> to C<sub>6</sub> made of 160-225 mm L=1800m long polyethylene corrugated socket pipes is planned. Besides, implementation of 72 linear and angle inspection chambers are planned. Through the designed main sewer collectors wastewater is transported by gravity to the existing sewerage network of the town.

Intersections are possible between the designed sewage system and the water supply system pipes.

To rehabilitate Sisian town’s water supply system, the following is planned:

- to construct about 2.6 km long DN63-DN225 (HDPE) polyethylene water pipelines,
- to construct new inlet lines for the existing 33 apartment and public buildings, with 1.1 km total length, made of DN32-DN90 and DN50 (HDPE) polyethylene and steel pipes,
- to construct new inlet lines (0.8 km) for individual houses and commercial facilities, made of DN20-DN25 (HDPE) polyethylene pipes,
- to install 33 D=2.0m, D=1.5, D=1.0m, H=1.8m sized r/c precast regulation/control valve chambers in the water distribution network,

- to install 5 underground fire hydrant chambers are planned in the distribution network; the selected option and the location of the fire hydrant chambers is agreed with the corresponding department of the RA Ministry of Emergency Situations

To rehabilitate *Sisian town's* sewerage system, it is planned to reconstruct the left-bank district's apartment buildings' network.

Construction of sewer collectors conventionally numbered C<sub>1</sub> to C<sub>26</sub> made of 160-250 mm, L = 3324m long polyethylene corrugated socket pipes is planned in the different streets, as well as implementation of 180 linear and angle r/c D = 1.0m inspection chambers. Through the designed C<sub>1</sub> and C<sub>26</sub> main sewer collectors wastewater is transported by gravity to the existing and operating sewerage network of the town, joining the 200-500 mm collectors. Reconstruction of the existing inspection chambers in all connection points with the existing collector is also planned.

Parallel with the reconstruction of the sewage network, reconstruction works of the pipelines of the water distribution network and the inlet pipes of apartment buildings will be implemented in the same district, therefore, the crossing of sewage collectors and water supply pipes is possible.

When the distance between the walls of the intersecting pipes does not exceed 0.4 m, irrespective of the condition whether the water supply pipe passes above the sewer pipe or underneath it, it is necessary to plan a casing pipe on the laid water supply pipe.

To rehabilitate *Darbas village's* water supply system, it is planned to reconstruct “Yot aghbyur” and “Saghkarsu” spring intake structures, which are conditionally numbered as spring intake N1 and N2. For implementation of construction in the area of the spring intakes and for their further operation about 3m wide 1300m and 100m long road-shelves are to be constructed to “Yot aghbyur” and “Saghkarsu” spring intake respectively. The trenches of the pipes from the spring intakes will be implemented along the same road-shelves.

DD plans construction of a 200m<sup>3</sup> capacity DRR on the higher-located part of the village, at 1589.05 m absolute elevation, including the dry chamber, chlorination station and wastewater storage chamber.

Rehabilitation of the internal water supply network includes construction of about 6.017 km long DN32-DN160 (HDPE) polyethylene water pipelines, as well new inlet lines for 220 individual houses made of DN20-DN25 (HDPE) polyethylene pipes, with about 3292.0 m total length, with installation of polymer-sand water metering chambers, including the water metering node set and the connection to the customer's existing inlet line. It is planned also to construct new inlet lines for 10 public buildings of the settlement, with 100.0m total length, with installation of r/c water metering chambers, including the water metering node set and the connection to the customer's existing inlet line.

The design plans a total of 13 r/c precast regulation/control valve chambers in different parts of the distribution network and 5 underground fire hydrant chambers.



The water supply of Shinuhayr village is planned to be implemented by constructing a new total 507.0m long polyethylene water main. The beginning 60.0m long segment of the water main is planned to be implemented from DN250 (HDPE) polyethylene pipes and the remaining part from DN225 (HDPE) polyethylene pipes. It is planned to build a 2.5x2.5m r/c valve chamber in the connection node. The water metering chambers existing at the former supply point of the Shinuhayr and Khot villages on the Mukhuturyan-Goris-Kornidzor water mains and located at about 7 m from that point will also be repaired.

This DD also plans to reconstruct the L = 1352.0m long emergency segment of 4.5km long water main supplying Shinuhayr village with DN160 (HDPE) polyethylene pipes. Construction of pressure reducing and outlet chambers is planned on the reconstructed segment of the water main.

DD plans construction of a 300m<sup>3</sup> capacity DRR on the higher-located part of the village, at 1590.23 m absolute elevation (the place of the DRR was agreed with the community head).

For the DRR's sanitary protection zone, a metal fence of 203.5 m perimeter is planned.

To rehabilitate the distribution network of Shinuhayr, the following is planned:

- to construct about 11.1 km long DN32-DN225 (HDPE) polyethylene water pipelines
- to construct new inlet lines for 362 individual houses made of DN20-DN32 (HDPE) polyethylene pipes, with about 6732.0 m total length, with installation of polymer-sand water metering chambers, including the water metering node set and the connection to the customer's existing inlet line,
- to construct new inlet lines for 12 public buildings of the settlement, with 640.0m total length, made of DN32(HDPE) polyethylene pipes, with installation of r/c water metering chambers,
- to replace the inlet lines of 10 3-storey apartment buildings, with 335.0m total length, made of DN63(HDPE) polyethylene pipes, including the valve chambers and the connections to the existing inlet lines.
- to install a total of 18 r/c precast regulation/control valve chambers and 7 underground fire hydrant chambers.

Table 1 Brief description of the planned works

Works	M/U	Settlement											
		Yeghegnadzor			Sisian			Darbas			Shinuhayr		
		Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road
Reconstruction / construction of water springs	piece								2				
Construction / reconstruction of external water supply network, their washing and disinfecting	km								16.212				1.859
								2.95	4.862	8.4 (for 1.2km, a new road-shelf is opened)	0.014		1.845
Construction / reconstruction of internal water supply network, their washing and disinfecting	km					2.6			6.02				11.1
					0.4 0.24 (concrete tiles)	1.96		1.376	4.084		0.12	10.98	
Construction of DRRs and sanitary zones	piece								1				1
								The new DRR subject to construction is planned in a privatized area, however, the community administration got an agreement to replace this area with another area and to change the land category, which is now ongoing			Community lands		
Construction / reconstruction of chlorination stations	piece								1				

Works	M/U	Settlement											
		Yeghegnadzor			Sisian			Darbas			Shinuhayr		
		Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road	Asphalt road	Earth road	Field earth road
Construction of inlet lines of private houses and inlet lines of public facilities	km				0.8			3.292			6.732		
					0.8			0.432	2.86		0.96	5.772	
Connection of water metering nodes of private houses	set				40			220			362		
Construction of inlet lines of apartment buildings	km				1.1						0.335		
					0.1	1.0					0.335		
Construction of water supply, pressure regulation and water metering chambers	set				33			37			19		
Construction of fire hydrants	set				5			5			7		
Construction / reconstruction of internal sewerage network	km	1.8			3.32								
		0.2	1.6		0.443	2.877							
Construction / reconstruction of inspection chambers	piece	72			180								

After completion of works in asphalt-covered streets in good condition, the cover to be rehabilitated shall be of the same quality. The excess soils and construction waste of the excavated trenches shall be removed to the landfill allocated for the communities, at distance mentioned in the document issued by community head.

## 5. BASELINE ENVIRONMENTAL CONDITIONS

### 5.1. GEOGRAPHIC LOCATION AND CLIMATE OF THE SETTLEMENTS

Yeghegnadzor town is the center of Vayots Dzor region and occupies the western part of the Vayq valley. It is located at about 120 km south-east of the capital Yerevan, on the right side of the Arpa River, on the right and left banks of the Srkghonk tributary of the Arpa River.

The town has complicated and cut relief and is located at 1100-1325 m absolute elevation.

The town has low mountainous relief with tablelands and foothills. Erosion abrasion and arid abrasion fragmented relief types are mostly common.

The highway connecting Yerevan with Syunik marz and Artsakh Republic passes through Yeghegnadzor.

The climate is dry, continental, with cold or moderately cold winters and hot or warm summers.

The average air temperature in January is  $-5-6^{\circ}\text{C}$ , with a minimum of  $-22^{\circ}\text{C}$ , in July  $+35^{\circ}\text{C}$ .

Absolute temperature variations can reach up to  $60^{\circ}\text{C}$ .

Daily temperature variations in the town are great. The average annual precipitation is 400 mm.

Streams formed of heavy rains often cause mudflows.

Maximum land freezing depth is 81 cm.

Studies by the State Hydro meteorological and Monitoring Service of the RA Ministry of Emergency Situations have shown that in the Vayots Dzor region increase of air temperature and decrease in atmospheric precipitation is observed caused by climate change. According to climatic scenarios, the average temperature in the region will rise by  $6^{\circ}\text{C}$  by 2100, and the precipitations will decrease by 21.4%.

According to the RA National Statistical Service's website data, the population of Yeghegnadzor as of 01.01.2016 is 7675 people, 520 of which live in Gladzor district.

Sisian town is located in the central part of the Syunik marz of Armenia. Distance from the capital Yerevan is 217km. It is located on the right and left banks of the Vorortan river, at 1600m absolute elevation.

The number of the permanent population as of 01 January 2016 was 14858 (right bank district - 8022 people, and left-bank district - 6834 people).

Sisian region is located in the cold climatic zone. The climate of the region is characterized by cold mountainous, windless winters and warm summers, where the average monthly temperature in July is  $+16^{\circ}\text{C}$ , and the average January temperature is  $-5^{\circ}\text{C}$  to  $-12^{\circ}\text{C}$ . The absolute maximum air temperature is  $+20^{\circ}\text{C}$ , and the absolute minimum is:  $-15^{\circ}\text{C}$ . Average annual precipitation is 400- 750 mm. The thickness of the snow cover reaches up to 50 cm.

The soil freezing depth is 92 cm.

The average relative humidity of the air is 45-60%.

North-western winds dominate over the year, with average annual wind speed of 3-5 m/s.

Studies on climate change and forecasting in the RA have shown that in Syunik amount of precipitation in vegetation period will increase to some extent. The precipitation in the cold season of the year will also increase by 30.6%.

Darbas and Shinuhayr villages are located in the RA Syunik marz.

Darbas village is located in Lordzor Valley of Sisian region, at 25km distance of Kapan.

The village is one of the oldest settlements of Syunik marz, with many historical monuments (the ruins of 13th century Snt. Mary Church, 14-15th century cross stones, 17th century Arzumani Bridge, etc.).

According to the data from the village administration, the number of the population in the village as of 01 January 2016 was 685.

The population is mainly engaged in cattle breeding, crop cultivation, horticulture.

Shinuhayr village is located in Goris region, at 17 km distance from the town of Goris. At present, it is part of the Tatev community with 7 other villages (Tatev, Khot, Harzhis, Halidzor, Svarants, Tandzatap, Kashuni) and is a community center.

The Tatev community area extends from the north to the south-east from the Yerablur plateau and extends to the canyon of the Vorotan River, continuing to the south-west of the valley. In the south-eastern and southern parts of the river, right on the banks of the river, in the valley, there are bushy lands adjacent to a thick forest. The community has cut fields, hills, valleys, gorges, mountains, and uneven areas.

The village Shinuhayr is located in the Vorotan Gorge, on the left bank of the river, at an altitude of 1450 m above sea level. The administrative area of the village includes 16 ha of specially protected areas.

The population of the village as of 01.01.2016 was about 2640 people.

Climatic conditions are variable. Winter is cold, windy. Summer is cool, sometimes hot and drought. The spring comes early in the gorge, and the autumn lasts long. The snow cover in the area of Yerablur is longstanding and is accompanied by strong winds. The roads are closed sometimes and the traffic is stopped. There are heavy rains in the spring. The fog is an inseparable companion of the Vorotan valley most of the year.

The Kusanats Anapat church complex, St. Astvatsatsin Church (1676), St. Stepanos basilica church and a cemetery called "Khacher" with the monumental 3-m monument-khachkar (1261) are located in the area of Shinuhayr

## **5.2. GEOLOGY OF THE STUDIED AREAS**

Yeghegnadzor town is located in Vayots Dzor marz, a bowl-shaped depression surrounded by mountains, with a complicated and fragmented surface. The eastern border of the marz with Syunik passes on the northern higher-located picks of Zangezur mountain range.

The geological structure of the area is represented by sedimentary, volcanic and volcanic-sedimentary rocks, such as basalt, sand-stone, etc. These layers are covered with Quaternary formations of alluvial origin - clay, sand and coarse rocks; their thickness exceeds 15.0 m in some cases.

Here, mudflow proluvial cones of tributaries and temporary water courses are developed.

From the hydro-geological point of view, groundwater is widespread in the region. According to water bearing features, the rocks and soils in the region are divided into 3 groups:

- water bearing complex of deluvial-proluvial sediments;
- complex of Quaternary lava sediments;

- complex of Metamorphic and igneous rocks.

From seismotectonic point of view the region is located in Vayots Dzor, in the Gladzor river gorge.

According to HSHN II-6-02.2006 the region and the area are within the III (third) seismic zone, with background value of maximum acceleration coefficient (g)  $A_{max}=0.30g$  (see Figure 6.2).

Among dangerous physical-geological processes and phenomena are collapses, mudflows, stone collapses, floods, side and riverbed erosion, surface washing, local flooding, etc.

From geomorphological point of view *Sisian town, Shinuhayr and Darbas communities* are located in middle-height mountain belt, characterized by lava-covered plains, v-shaped deep gorges and a landscape cut with rivers. The relief is characterized by volcanic-erosion and hydro-erosion forms, severe surface scattering, and physical weathering. The dominating surface inclination is 5-10°

The region's geological structure is represented by volcanic and volcanic-sedimentary rocks, such as porphyrites, tuff-breccia, etc., volcanic formations of Pliocene Miocene period. The mentioned strata are overlaid by Quaternary formations of alluvial origin, such as clay, sand and coarse soils. Their thickness in some cases exceeds 20.0 m.

From the hydro-geological point of view, groundwater is located at lower horizons, since the formations of volcanic origin are characterized by severe fracturing. Groundwater sites located 3-5m higher of the ground surface occur only in the terraces of the Vorotan river and its tributaries.

According to water bearing features, the rocks and soils in the region are divided into 3 groups:

- water bearing complex of deluvial-proluvial sediments;
- complex of Quaternary lava sediments;
- complex of Metamorphic and igneous rocks.

Among exogenous geological phenomena are storm flows, weathering, river bed deepening, and stone collapses and landslides in slopes.

From seism tectonic point of view the region is located in Syunik Highland.

According to HSHN II-6-02.2006 The possible magnitude of earthquakes in the region is 8-9, and the maximum horizontal acceleration is 0.2g- 0.3g.

Among dangerous physical-geological processes and phenomena are landslides, collapses, mudflows, stone collapses, floods, side and riverbed erosion, surface washing, local flooding, etc.

## 5.3. BIODIVERSITY

### 5.3.1. Yeghegnadzor

There are relatively favorable conditions in Vayots Dzor marz, since there are no mining companies polluting the environment. The ecological purity of air, water and food in this area is also conditioned by this circumstance. The area is distinguished by its rich and unique biodiversity.

**Flora.** Yeghegnadzor is located in Vayots Dzor marz, which is unique with the variety of flora. Over 1650 types of plants (half of the plant types growing in Armenia) can be found here. There are sporadic plant species. Also species of medical herbs are dominating. Favorable natural climate conditions and geology provide an excellent environment for a wild variety of plant species.

Other types of plant species include xenophile, steppe, forest, alpine and aquatic species. The junipers of Vayk are especially prized.

The region is poor in forests (3,700 ha or 1.6% of the area). But the 155 tree species of the forests are mostly valuable, rare and endemic species. Many plant species in Vayots Dzor are registered as endangered, and are in strong need of protection.

Vegetation of the area subject to immediate impact

Within Yeghegnadzor town area dry steppe landscape dominates, where there are some frangipaniumous plants (Rhamnus, Almond tree, Ephedra, juniper, Poa, Stipa, Bromus, etc.).



*Ephedra*



*Almond tree*



*Stipa*



*Bromus*

The town's wastewater system improvement works will be carried out in a relatively new Gladzor district, which has already turned into an urban landscape. There are no natural landscapes on which construction works can have impact.

**Fauna.** The diversity of natural conditions in the region also conditioned the existence of a rich fauna. Out of the 460 species registered in Armenia, 225 live here. Most of them are registered in the Red Book, and many occur only here. Bezoar goat, wild sheep or moufflon, partridge, quail, wild turkey, many species of sparrows, predatory birds, eagles and vultures, rare species of fish, brook trout, beghlou, Salmo, rare serpents and lizards, wild pig, brown bear, fox, wolf, rabbit, leopard, lynx and so on.

In the region of Yeghegnadzor there are mainly Bezoar goat, jackal, fox, rabbit, among reptiles - Mediterranean turtle, gyurza, viper, among birds - partridge, sparrow. There are many types of insects.

*Fauna of the area subject to immediate impact*

The natural landscapes are missing in the area subject to immediate impact and the fauna is mainly represented by urban bird species, sparrows, crows, turtles, etc.

**Aquatic ecosystems**

The Srkghonk River flowing through the town of Yeghegnadzor, which is the tributary of Arpa, does not flow through this part of the town. This river will not be affected during the construction work.

**Specially protected natural areas**

There are no specially protected natural areas in Yeghegnadzor. At respectively 23 and 15 km distance of the town, Yeghegnadzor and Herher reserves are located, which are outside of the project's immediate impact zone.

**Historic-cultural monuments**

Yeghegnadzor is rich in valuable architectural monuments and complexes: Khachik Khotakerats (9<sup>th</sup> century), Arates (11-13<sup>th</sup> centuries) monasteries, Areni Astvatsatsin (13<sup>th</sup> century), Alayaz Zorats and Surb Nshan (13<sup>th</sup> century) churches, Tsaghatsqar (10-11<sup>th</sup> centuries), Tanade (13<sup>th</sup> century), Vernashen Spitakavor Astvatsatsin (12-13<sup>th</sup> centuries) monasteries, Amaghov Noravank (13-14<sup>th</sup> century), Smbataberd and Proshaberd fortresses, Late Middle Ages Shatin (17<sup>th</sup> century), Hermon (17<sup>th</sup> century), Holy Cross of Arkaz (17-19<sup>th</sup> centuries) monasteries.

**5.3.2. Sisian, Darbas, Shinuhayr**

Thanks to geographical position, dissected relief, inter-relation of different inclination slopes and floristic provinces, the Syunik marz is well known for its rich landscape and biological diversity. Various high altitude zones (3904 m / Caputjur / - 375m / Meghri/) and different climate variations have contributed to the enrichment of biodiversity and ecosystems in the region. A number of specially protected natural areas (SPNA) have been created in the region to protect landscape and biological diversity.

**Flora.** The town area soils are mostly light brown pebble soils, with steppe vegetation, with dominating cereal plants.



Trees are represented mainly by xenophile sparse vegetation types, including juniper, mixed species and plum and pear trees. Occasionally, the furrow and rocky vegetation occur. Furrows are mostly sparse in all areas, preferring humid habitats. The mountainous vegetation of the area is distinguished by cereals. Compositae have most varieties of species in this landscape zone and include 49 species; cereals - 34 species, beans and roses - 23 species, brassica - 7 species. About 100 herbs are included in the list of wild medicinal and edible plants.

Vegetation of the area subject to immediate impact

The area of urban community of Sisian is located in Sisian syncline site of North-Zangezur mountain-syncline sub-region's mountain-steppe zone of Zangezur syncline landscape region. On the slopes of the Sisian syncline mainly light brown lands are spread, and in the floodplain - alluvial lands with lush meadow vegetation. Fescue and Stipa steppes are spread on light brown soils. The vegetation producing background is *Stipa capillata*, sometimes accompanied by wormwood. They are mainly cultivated and used for cultivation of cereal crops, as well as for grasslands.

Forest plantations are characterized by broad-leaved forms of plants, in particular: *Fagus orientalis* Lipsky, *Quercus iberica* Stev. *Q. macranthera* Fisch. Et Mey. Ex Hohen, (*Carpinus betulus* L., *C. Orientalis* Mill, *Fraxinus excelsior* L., *Tilia begoniifolia* Stev.



*Carpinus caucasica*



*Fraxinuma excelsior*



*Phleum*



*Bromus.*

The town's water supply and wastewater system improvement works will be carried out in the left-bank district which has already turned into an urban landscape. There are no natural landscapes on which construction works can have impact.

**Fauna:** The fauna of Sisian region is rich in endemic invertebrate species, including: *Phytodrymadusa armeniaca*, *Nocarodes armenus*, *Cantharis araxicola*, *Tomomyza araxana*, *Bombilius schelkovnikovi*, *Gabbiella araxena*, *Pupilla bipapulata*, *Zodarion petrobium*. In rivers and tributaries 6 species of fish live, of which *Salmo trutta fario* is the most valuable species. In the area under study, mammals include 3 species of insect-eaters, 6 species of bats, 15 species of rodents, 9 species of predators, and 4 species of hoofed animals. In forests there are *Erinaceus concolor*, *Dryomis nitedula*, *Mustela nivalis*, *Martes foina*, *Vulpes vulpes*, etc.

Amphibians are represented in 4 species and reptiles include 11 species of lizards, 13 species of snakes and 2 species of turtles. Bird fauna is represented by 141 species, mostly living in forests.

*Fauna of the area subject to immediate impact*

The natural landscapes are missing in the area subject to immediate impact and the fauna is mainly represented by urban bird species, sparrows, crows, turtles, ducks, as well as rodents, insects etc.

**Aquatic ecosystems**

Sisian stretches on the right and left banks of the Vorotan River. The riverbed is wide (1.5 km) in the town, and the banks are swampy.

In the Vorotan River's higher located cold water the valuable cruciferous fish species breeds, which, however, rarely occurs at present due to the deliberate hunting. In the town's area, the river is polluted mainly by household waste (solid household wastes and household and industrial wastewater). During construction, this river will not be affected, as the construction site is located in the yards of apartment buildings, at least 25-30 meters away from the river.

The small river Lusadzor, a tributary of the Vorotan river, flows through Darbas village. It is polluted with solid household waste and household and cattle wastewater. There are no fish species in the river, and the benthos species are not studied.

During the construction works, the water main entering the village will pass about 300 m along the road parallel to the river, at a distance of 20-100 m from the river. On its way to the village the water main will cross the river (the water main is planned to be implemented under the riverbed), and a span passage is planned over the bridge in the village.

**Specially protected natural areas**

There are no specially protected natural areas in Sisian's administrative area. At 22 km distance of the town, "Sev Lich" state reserve is located, which is outside of the project's immediate impact zone.

**Historic-cultural monuments**

Sisian is rich in ancient monuments and complexes, castles, tombstones, cross-stones (10-12<sup>th</sup> cc). The citadel is located in the center of the city, in the yard there are rock carvings from Ukhtasar (5-2 millennium BC). St. Hovhannes is located in the western part of the town (Church of St. Hovhannes of Sisavan, Syuni Vank), which is constructed in 670-689.

**Darbas and Shinuhayr villages**, jointly with Sisian town are located in the same geographical zone and the flora and fauna species are the same.

There are no specially protected natural areas in these villages, but they are rich in historical and cultural values.

The ruins of the Surb Astvatsatsin Church, built in the second half of the XIII century are located in Darbas village. The village's cross-stones are attributed to the XIV-XV centuries. The bridge, built in 1675, known as the Arzuman bridge is also a famous monument.

In the old village of Shinuhayr, the tracks of the 18<sup>th</sup> century Shnher castle have been preserved. On the southern side, the Astvatsatsin Anapat complex (1676) is located and in the village itself, Surb Stepanos three-tier church (XVII century) and "Khacher" cemetery (1261) are located.

## 6. ENVIRONMENTAL, SOCIAL AND CLIMATE IMPACTS

As a result of the works aimed at the improvement of water and wastewater systems the expected positive population health and social effects are as follows:

- water resource protection and sustainable use,
- excluding mixing of drinking, irrigation and sewerage water,
- preventing, excluding penetration of infectious agents in drinking water;
- reduction of drinking water pollution hazard,
- providing high drinking water quality,
- improvement of health condition of population,
- reduction of water losses,
- increasing duration of water supply to population,
- introduction of water metering system,
- increasing water consumption efficiency,
- improvement of sanitary and hygienic conditions of the population,
- exclusion of environmental pollution with household wastewater,
- exclusion of water pollution in the Vorotan River, improvement of river water quality;
- prevention of degradation of water and land ecosystems

The activities carried out under this package will have a noticeable positive impact on the social condition of the population. It will directly improve the quality of life of communities' population by providing sustainable and reliable water supply and wastewater disposal, saving water resources for about 25860 people.

### 6.1. ENVIRONMENTAL AND SOCIAL RISK ASSESSMENT

Initial environmental examination (IEE) revealed that the implementation of works aimed at water supply and wastewater systems improvement in the project settlements will not have irreversible harmful effects on landscapes, flora and fauna in the works implementation area.

The routes and places of structures for the newly designed W&W systems were selected, bypassing protected nature conservation areas and important landscapes, as well as privatized areas (except for the Darbas Village DRR, which is planned on a privatized land area, and a process is underway to provide the owner with an equivalent land area), aimed at minimizing the environmental and social impacts of the project; the shortest possible routes were selected to avoid increasing of the cost of construction.

The project's environmental risks are primarily related to the construction of water pipelines passing through field roads, which, as shown in Table 1, are present during the reconstruction of water mains of Shinuhayr (1.8 km) and Darbas (8.4 km) villages, as well as during the opening of new road-shelves (1.2 km) during the reconstruction of the Darbas village's water main. During these activities it is possible to physically injure grasslands, arable lands with construction machinery, materials and equipment.

During construction / reconstruction of wastewater collectors and building networks in Yeghegnadzor and Sisian towns, as well as during reconstruction of inspection chambers, environmental pollution with household wastewater and a violation of sanitary and hygienic safety in those areas is possible.

The land category change for the newly designed DRR in the Darbas community is still in process and has not been finally settled (it is planned to construct the DRR in a privatized land area and provide the owner with another appropriate area).

During the construction works, the water main entering the village will pass about 300 m along the road parallel to the river, at a distance of 20-100 m from the river. On its way to the village the water main will cross the river (the water main is planned to be implemented under the riverbed), and a span passage is planned over the bridge in the village, during which violation and pollution of the river bed and banks are possible.

Potential risks during replacement of water supply networks within the settlements and construction of individual houses' inlet lines are safety of residents and workers/staff, disruption of pedestrian and traffic roads, air pollution with dust.

The probable negative effects might be mainly caused by construction works implementation, and expected to do limited damage and be temporal.

The following negative impacts are also expected during the construction works:

- Air pollution
- Soil erosion
- Pollution of environment and water resources with construction and household waste
- Pollution of soil and water resources with fuels and lubricants
- Water and soil pollution with chlorine
- Noise and vibration
- Damage to arable lands and grasslands
- Temporary disturbances to roads to the arable lands of the communities
- Disturbance of road and pedestrian roads within the communities and increase of traffic load
- Infringement of occupational health and safety requirements for staff
- Ignoring safety measures for residents.

To minimize or prevent the negative impacts, mitigation measures were envisaged and an Environmental and Social management and monitoring plan (ESMMP) was developed, which should be followed by the contractor, controlling and supervision units.

The Environmental and Social Management Plan (ESMP) is an integral part of the environmental assessment document and is included in detailed designs.

## **6.2. ENVIRONMENTAL IMPACT MITIGATION MEASURES**

Adverse impacts on the environment and human health while implementing construction works for improvement of water supply and wastewater systems of Yeghegnadzor and Sisian towns, Darbas and Shinuhayr villages are possible during the construction of: (i) trenches for water lines

and sewerage lines, (ii) pits for regulating and water metering nodes and inspection chambers, (iii) construction/reconstruction of DRRs, pump stations and chlorination stations.

To prevent air pollution with dust generated during the construction work, the construction site and roads must be regularly watered, especially in dry weather. Dry, dusty materials are to be transported by trucks with covered carriages. Exclude burning of household garbage in the construction site.

To prevent contamination of land and water resources with household wastewater during the construction / reconstruction of sewage collectors in Yeghegnadzor and Sisian towns, it is necessary to strictly follow the activities specified in the DD.

After construction of sewage collectors in Gladzor district of Yeghegnadzor town, it is necessary provide a direct flow of the district wastewater to the collectors, without allowing the wastewater flow to the environment and to ensure the gravity flow of household wastewater into the existing and operating sewerage network of the town.

Ensure the safety of drinking water pipes at possible intersections between the sewage system pipes and the existing water supply system pipes, to exclude the possibility of mixing household wastewater and drinking water. In these segments, protect the drinking water pipes with casing pipes.

The manholes shall be built very quickly (within 1 day), excluding the pollution of the environment, residential areas with wastewater.

To prevent soil erosion and sediment transport, the following is to be implemented: in inclined sites of the water line and sewer line routes implement measures for retaining the inclinations (particularly the first 2km segment of the Darbas village's water main, which passes on slopes); minimize the time during which trench and pit excavations for regulation and metering nodes, inspection chambers are open.

- At works near river and tributary bed areas, the inclinations should be retained to prevent soil erosion and sediment transport.
- After completion of the construction works, clear all construction sites from the construction waste and bring them to the original shape.
- Recover the asphalt – concrete pavement, providing its previous good condition and quality.
- Provide graveling with compaction on the streets with damaged and half-destroyed asphalt-concrete pavement, as well as on earth roads.

To prevent the topsoil layer damage, or landscape degradation during the construction of water mains passing through field roads, if necessary, the topsoil of the sites adjacent to the roads should be removed and stored on the assigned site, thereafter used for the areas restoration. The construction site should be cleaned from the household and construction waste providing the previous state of landscape.

To exclude land and water resources pollution with fuels and lubricants, the latter must be stored on a sealed surface, away from water resources; plan use of special tanks for their collection, which will then be removed to special sites envisaged for re-treatment.

To prevent violation of aquatic ecosystem, during the construction of the water main of Darbas community (underground passage) it is to be ensured that during opening of the river bed the pebble and sand is transported to an appropriate site and the river bed and banks are rehabilitated immediately after the completion of works, according to their previous structure.

When crossing the river (over the bridge), put the supports of the water main must be installed in a place that will exclude disruption of the river banks and bed.

To prevent environment pollution with construction and household waste, remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.

To exclude land and water resources pollution with chlorine, organize works for washing the water supply distribution network with chlorine, according to calculations. Provide appropriate technical means; implement chlorine discharge to surface water body or land area after washing the pipes, according to the planned regime.

Before removing the chlorine-containing wastewater stored in the chambers near the chlorination stations during operation of the chlorination stations to the water body or land area, ensure that the permissible limit amounts are met and implement the discharge according to the prescribed regime.

Drinking water quality change – The Environmental monitoring plan must include also control over water quality and residual chlorine level.

Veolia Djur will implement planned sampling of supplied water, checking the quality of the water of the water sources, according to all the parameters required by the Ministry of Health. Water quality monitoring is carried out also by State Hygienic and Epidemiological Surveillance Inspectorate, according to "Drinking Water. Requirements to the Centralized Water Supply System's Water Quality"; Quality Control № 2-III-A'2-1 sanitary rules and norms" (registered on 28.12.2002), document, which establishes the requirements to the drinking water quality, as well as the rules for quality control of water produced and supplied to residential area through water supply systems.

Since drinking water is chlorinated, it is also important to monitor the residual chlorine in drinking water.

To prevent noise, night work in residential areas is to be limited, and usage of machines/equipment with extra noise is to be avoided; installation of silencers if needed.

To reduce the negative impact on pastures and grassland, it is planned to carry out construction works in autumn after grass harvesting. In the course of construction works, the access of vehicles to these areas is to be restricted to the extent possible. Restore damaged areas after construction.

To reduce disturbance to population because of overloaded roads safe area for trucks is to be provided; waste on the construction site must not be accumulated and burnt, construction should be implemented in stages, adequate notice of construction activities must be given to the population, effective road signs, diversions or barricades are to be provided.

To prevent hazards for workers and the population during the construction, the following must be implemented: install fencing around construction site; control access of unauthorized persons to site; place warning signs in dangerous places; carry out regular examination of equipment by highly qualified staff, as well as make regular safety audits; provide first aid and safety training to construction staff.

Provide meeting the occupational health and safety rules according to the 3 B document.

Provide community participation in subproject design, which will minimize disruption to community social activities.

### **6.3. INSTITUTIONAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT**

The organizational obligations for the proposed mitigating measures are distributed among the following agencies:

❖ ***Executive agencies, which are responsible for implementation of the measure.***

1. For this special task the executive agency (SAFEGE SAS - JINJ Ltd. Consortium) must provide in the design stage obtaining of all the required agreements and permits from corresponding state and local authorities, before tendering the construction works;
  - Conclusion of technical expert examination;
  - Conclusion of environmental expert examination (if needed);
  - Agreement of the State Agency for Protection of Historical and Cultural Monuments, if impact is envisaged by the design.
2. The executive agencies in the construction stage (construction contractors) will be responsible for physical implementation of mitigating measures planned under the ESMP, as well as for obtaining of all permits and agreements required during the construction implementation. Those are:
  - Construction permit from the local self-governing authorities,
  - Agreements from the local self-governing authorities for the sites allotted for transportation of wastes and construction garbage,
  - Agreement of the State Agency for Protection of Historical and Cultural Monuments, if unexpectedly historical and cultural or archaeological monuments are discovered during the construction implementation.
3. Before commencement of the construction, the following permits and certificates must be obtained from PIU, if needed:
  - Cadaster certificate on the land allotment;
  - Water use permit, if needed.



❖ ***Controlling agencies, which are responsible for controlling the executive units to provide implementation of the ESMP measures by the latter***

1. Veolia Djur CJSC's / PIU's environmental specialist will be responsible for in time, due and reliable implementation of the works and measures in the order under the ESMP. The mentioned specialists will regularly visit the construction sites to provide due implementation of the measures aimed at mitigation of work impact. During the visits the possible gaps will be identified through the check list and the infringements in implementation of mitigating measures will be discovered.

The Veolia Djur CJSC/PIU has the right also to require and check whether all permits are available and valid, all the measures and monitoring part under the ESMP are implemented during the construction, in accordance with KfW guidelines and the RA environmental and social legislation.

2. SAFEGE SAS – JINJ LTD Consortium will also implement control of implementation of mitigating measures during the construction. The environmental specialist shall make visits to control the ESMP implementation.

❖ ***State monitoring agencies, which are responsible for observing the extent and efficiency of ESMP implementation and making corrections in the project, if needed.***

The state monitoring agencies are as follows:

- Inspectorate for Nature Protection and Mineral Resources under the Government
- Health and labor inspection body under the Government
- Service for the protection of historical environment and cultural museum reservations NCSO, as necessary
- RA local self-governance bodies,
- RA Ministry of Transport, Communication and Information Technologies.

The amounts envisaged for implementation of environmental measures included in the ESMP are included in the detailed design.

Implementation of mitigating measures for environmental impacts will be controlled regularly through visits to the construction sites. With the help of the specially developed check list the gaps and drawbacks will be discovered.

In case of not implementing or infringing the implementation of the mitigating measures, after warning, the Contract provision envisaged for this case will come into force.

## **6.4. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)**

The Environmental and Social Management Plan (ESMP) will be based on the results of IEE prepared by subproject and will include appropriate mitigation measures.

ESMP consists of two components:

1. Mitigation measures and institutional responsibilities for implementation;
2. Environmental monitoring.

The Contractor should strictly follow the environmental mitigation measures prescribed in the ESMP. The costs foreseen for the implementations of all the measures prescribed in the ESMP are included in the total cost of the Contract.

Notice by the Technical Supervision Company (TSC) or the Client on the failure to implement measures prescribed in the ESMP would be sent to the **Contractor** in written. After the Notice to Correct, the next recorded violation would trigger the damage compensation mechanism, which will be included in the Contract signed with the Contractor.

The Environmental and Social management and monitoring plan is presented in Table 2.

## 6.5. ANALYSIS OF ALTERNATIVES

Alternatives of the works to be implemented under the project package were discussed, and as a result of the discussions during the preliminary design development and those with the Client, community leaders and the population, as well as based on the economic and technical calculations the works planned under the detailed design for the rehabilitation of water and wastewater systems were selected.

The routes and places of structures for the newly designed W&W systems were selected, bypassing protected nature conservation areas and important landscapes, as well as privatized areas, aimed at minimizing the environmental and social impacts of the project; the shortest possible routes were selected to avoid increasing of the cost of construction.

As an alternative option, we consider only “zero” or “no project” version, in case of which no work is done in the above-mentioned communities.

As a result: Household wastewater is not removed from Yeghegnadzor town’s Gladzor district, but is discharged to open land areas, polluting the environment, degrading land resources, creating an anti-sanitary situation in the district and beyond its boundaries, or flows into the Srkghonq River, contaminating the water resources, worsening irrigation water quality and breaking the ecological balance of the river.

As a result of leaving the water supply system of Sisian town’s left-bank district in the same condition, we have huge losses of water resources, qualitative and quantitative requirements for drinking water are not met, and residents have health and social problems.

In case of not rehabilitating the wastewater system, the situation will remain as it is today. The household wastewater of the town’s left-bank district is discharged to open land areas, polluting the environment, degrading land resources, creating an anti-sanitary situation in the district and beyond its boundaries. A part of wastewater flows into the Vorotan River, contaminating the water resources, worsening irrigation water quality and breaking the ecological balance of the river and harming the aquatic biodiversity.

As a result of leaving the water supply systems of Darbas and Shinuhayr villages in the same condition, we have huge losses of water resources, qualitative and quantitative requirements for drinking water are not met, and residents have health and social problems.

**Table 2. Environmental and Social Management and Monitoring plan**

<b>Works and possible impacts</b>	<b>Proposed mitigating measures</b>	<b>Monitoring</b>	<b>Responsible bodies</b>
<b>Construction</b>	<b>Construction</b>	<b>Construction</b>	<b>Construction</b>
1. <i>Air pollution in settlements</i>	<ul style="list-style-type: none"> <li>- Install fencing around the construction site.</li> <li>- Regularly water the construction site and roads,</li> <li>- Provide body cover for trucks.</li> <li>- Do not accumulate and burn waste on the construction site.</li> </ul>	Daily site inspection	Contractor, Consultant, PIU
2. <i>Pollution of environment with household wastewater in Sisian and Yeghegnadzor towns</i>	<ul style="list-style-type: none"> <li>- Construct the inspection chambers within shortest possible term.</li> <li>- Pump the wastewater into the newly built collector through submersible pumps during implementation of connections of the reconstructed/ newly constructed collectors.</li> <li>- Exclude wastewater flow to the environment, land and water resources.</li> </ul>	Daily site inspection	Contractor, Consultant, PIU
3. <i>Soil erosion and sediment transport in sloped areas of water main laying</i>	<ul style="list-style-type: none"> <li>- In inclined sites of the water and sewerage line routes implement measures for retaining the slope.</li> <li>- Minimize the time during which trench and pit excavations for water and sewerage lines, regulation and metering nodes are open.</li> <li>- Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU
4. <i>Topsoil layer or landscape degradation in pastures and grasslands</i>	<ul style="list-style-type: none"> <li>- Remove and store the topsoil on the assigned site, at 300-500m from the construction site.</li> <li>- Cleaned the construction site from the household and construction waste.</li> <li>- Provide the previous state of landscape.</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU
5. <i>Land and water resources (rivers</i>	<ul style="list-style-type: none"> <li>- Store oil, fuels and lubricants on a sealed surface, away from water resources.</li> <li>- Allot isolated areas for the repair and charging of machinery, equipment with</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU

<b>Works and possible impacts</b>	<b>Proposed mitigating measures</b>	<b>Monitoring</b>	<b>Responsible bodies</b>
<i>flowing through settlements) pollution with fuels and lubricants</i>	<ul style="list-style-type: none"> <li>lubricants.</li> <li>- Plan specially designed storage tanks for the used lubricants, which will be subsequently removed to specific locations or to special sites for recycling.</li> </ul>		
6. <i>Environment pollution with construction and household waste</i>	<ul style="list-style-type: none"> <li>- Remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.</li> <li>- Install waste collection tanks in the construction sites and collect and remove them daily from the construction site.</li> <li>- Exclude the burning of household waste in the site.</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
7. <i>Land and water resources pollution with chlorine</i>	<ul style="list-style-type: none"> <li>- Implement disinfection of water mains and distribution network with chlorine, according to technical calculations.</li> <li>- Provide appropriate technical means for removal of chlorine water from washing.</li> <li>- Implement chlorine discharge to surface water body or land area after washing the pipes, according to the established order and the background value of the given water body.</li> <li>- Before removing the chlorine-containing wastewater stored in the chambers near the chlorination stations during operation to the water body or land area, ensure that the permissible limit amounts are met and implement the discharge according to the prescribed regime.</li> </ul>	During washing of pipelines	Contractor, Environmental inspectorate, Consultant, PIU
8. <i>Noise</i>	<ul style="list-style-type: none"> <li>- Limit night work in residential areas,</li> <li>- Avoid usage of machines/equipment with extra noise.</li> <li>- Install silencers if needed.</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
9. <i>Troubles and Dangers to Population:</i>	<ul style="list-style-type: none"> <li>- Implement the construction in phases, inform the population about the works.</li> <li>- Install appropriate traffic signs, barriers.</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

<b>Works and possible impacts</b>	<b>Proposed mitigating measures</b>	<b>Monitoring</b>	<b>Responsible bodies</b>
	<ul style="list-style-type: none"> <li>- Organize by-passes.</li> <li>- Mark the construction areas (trenches) with safety ribbons,</li> <li>- Ensure participation of the population in the implementation of the project, which will minimize the disruption of the social activity.</li> </ul>		
<i>10. Hazards for Workers</i>	<ul style="list-style-type: none"> <li>- Install fencing around construction site.</li> <li>- Control access of unauthorized persons to the site.</li> <li>- Place warning signs in dangerous places</li> <li>- Carry out regular examination of equipment by highly qualified staff,</li> <li>- Make regular safety audits of equipment.</li> <li>- Provide first aid and safety training to construction staff.</li> <li>- Provide workers with means necessary for work (overall, shoes, caps, earplugs, respirator masks, etc.)</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

## APPENDIX 1

**Դաշտային այցերի ստուգաթերթիկ**  
**Field visits checklist**

<b>Ընդհանուր տեղեկատվություն</b> <b>General information</b>	Ամիս/ամսաթիվ D/M/Y			
	Ենթաձրագիր / Subproject			
	Տեղակայում / Location			
	Շինարարական կազմակերպություն/ Constriction contractor			
	Մարզ / Marz			
<b>Նախագծում</b> <b>Design</b>				
<b>Անհրաժեշտություններ</b> <b>Required permissions</b>	Բնապահպանական փորձաքննության եզրակացություն / EEC	Այո Yes	Ոչ No	Ո/Կ N/A
	Հողհատկացման գրավոր համաձայնություն / written consent on land acquisition	Այո Yes	Ոչ No	Ո/Կ N/A
	Պատմամշակութային փորձաքննություն / assessment of impact on cultural heritage	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Շինարարություն</b> <b>Construction</b>				
<b>Անհրաժեշտ թույլտվություններ</b> <b>Required permissions</b>	Շին.թափոնների տեղադրման գրավոր համաձայնություն / written consent on disposal of construction waste	Այո Yes	Ոչ No	Ո/Կ N/A
	Անսպասելիորեն հայտնաբերման դեպքում պատմամշակ. համաձայնություն / written consent in case of sudden discovery of cultural heritage	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Հասարակության իրազեկում</b> <b>Public awareness</b>				
	Շին.աշխատանքների վերաբերյալ բնակչության համապատասխան իրազեկում համաձայն նախագծի / awareness of population regarding construction works according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
	Համայնքի մասնակցություն շինարարական աշխատանքներին համաձայն նախագծի / community's participation in construction works according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Անվտանգություն</b> <b>Safety</b>				
<b>Բանվորների անվտանգություն</b> <b>Safety of workers</b>	Բանվորների անվտանգության հանդերձանքի առկայություն /ականջակալներ, շնչադիմակ/ availability of safety uniforms (earflaps,mask)	Այո Yes	Ոչ No	Ո/Կ N/A

	Շինարարության մեջ ներառված տեխնիկական միջոցների պարբերական զննումներ՝ անվտանգությունն ապահովելու նպատակով / regular study of equipment used for construction for safety matter	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Բնակչության անվտանգություն Safety of population</b>	Երթևեկության սահմանափակման կամ խախտման ժամանակ համապատասխան ճանապարհային նշանների կամ պատնեշների տեղադրում, շրջանցի կազմակերպում / Installation of road signs or fences, organization of a bypass during interrupted or limited traffic	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շինարարության իրականացման ժամանակ կառավարման միջոցառումներ</u></b> <b><u>Management measures during construction</u></b>				
<b>Շին.հրապարակի/ տեղանքի շահագործում / Operation on area/construction site</b>	Շին.հրապարակի/տեղանքի պարբերաբար ջրում / regular sprinkling to area/construction site	Այո Yes	Ոչ No	Ո/Կ N/A
	Մեքենաների համար ապահով տարածքի առկայություն շին.հրապարակում / availability of safe place at the construction site for vehicles	Այո Yes	Ոչ No	Ո/Կ N/A
	Յուղերի և քսուկների համապատասխան պահեստների առկայություն շին.հրապարակում / availability of storage for oils and lubricants at the appropriate part of the construction site	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Օդի ժամանակավոր աղտոտում</u></b> <b><u>Temporary air pollution/dust</u></b>				
	Շինանյութ տեղափոխող բեռնատարների վրա ծածկի օգտագործում / use of cover for the vehicle transporting construction waste	Այո Yes	Ոչ No	Ո/Կ N/A
	Շինարարության տարածքի խոնավեցում ջրի շիթով / moisturing of the construction site by water	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Հողի էրոզիա</u></b> <b><u>Soil erosion</u></b>				
	Զառիվար տեղերում հողի էրոզիայի կանխարգելման միջոցառումների իրականացում ըստ նախագծի / soil erosion prevention measures at the slope places according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
	Փոստրակների ժամանակին հետլիցք / timely coverage of holes by soil	Այո Yes	Ոչ No	Ո/Կ N/A
	Շին.աշխատանքների ավարտից հետո վնասված մակերեսների վերանորոգում ըստ նախագծի / repair of damaged surface after completion of construction works	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Ջրի աղտոտում</u></b> <b><u>Water pollution</u></b>				
	Ջրի աղտոտում քսանյութերով և վառելանյութերով / water pollution caused by fuel and lubricants	Այո Yes	Ոչ No	Ո/Կ N/A

	Խողովակների լվացումից հետո քլորի արտահոսք համապատասխան նախագծով նախատեսված ռեժիմի / Leakage of chlorine after wash up of the pipes according to the scheduled regime.	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Աղմուկ բնակավայրերի տարածքին մոտ</u></b> <b><u>Noise close to settlements</u></b>				
	Աշխատանքների իրականացում սահմանված աշխատանքային ժամերին, հակառակ դեպքում սահմանված կարգով / implementation of the works during working hours, otherwise in projected manner	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շինարարական և կենցաղային թափոնների տեղադրում</u></b> <b><u>Construction west disposal</u></b>				
	Շինարարական և կենցաղային աղբի տեղափոխում և տեղադրում համայնքի համապատասխան աղբավայրում / transportation and disposal of construction and consumer waste in appropriate community landfill	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շահագործում</u></b> <b><u>Operation</u></b>				
<b>Խմելու ջրի աղտոտում / Drinking water pollution</b>	Մնացորդային քլորի քանակի համապատասխանում խմելու ջրի որակի նորմերին / Correspondence of balance quantity of residual chlorine to the quality of potable water	Այո Yes	Ոչ No	Ո/Կ N/A



**APPENDIX 2**

**Record of Interagency and Consultation Meetings**

*The records of the Consultation Meetings are given in Book 3-B-I.1.*

**APPENDIX 3**

**List of EA Report Preparers**

1. Arevik Hovsepyan – JINJ LTD, Head of Environmental Department
2. Lusine Vardanyan - JINJ LTD, Environmental Department officer
3. Hasmik Ghalachyan – Botanist, expert.

**APPENDIX 4****References**

The RA Law "On Environmental Impact and Monitoring" (2014)

The RA Law "On Flora" (1999)

The RA Law "On Fauna" (2000)

The RA Law on "Lake Sevan" (2001)

Red Book of Plants of Armenia (2009)

Red Book of Animals of Armenia (2010)

Sustainability guidelines of KfW Bankengruppe (adopted on 2 October 2012)

Sustainability Guideline: Assessment of Environmental, Social, and Climate Performance: Principles and Process April 2016

**APPENDIX 5****LIST OF ABBREVIATIONS**

AIC	Angular inspection chamber
DD	Detail Design
DRR	Daily regulation reservoir
EIA	Environmental Impact Assessment
EAIC	Existing angular inspection chamber
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
IESE	Initial Environmental and Social Examination
JV	Joint Venture
KfW	German Development Bank
LSGB	Local Self-Governmental Bodies
PIU	Project Implementation Unit
RA	Republic of Armenia
RA MoC	RA Ministry of Culture
RA MoH	RA Ministry of Healthcare
RA MoNP	RA Ministry of Nature Protection
RA MoT&C	RA Ministry of Transport and Communication
WRMA	Water Resources Management Agency
WWTP	Wastewater treatment plant
SNIP	Construction norms and rules

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"COMMUNAL INFRASTRUCTURE PROGRAM (CIP) II,  
PHASE 3 - ARMENIA, WATER AND SANITATION"

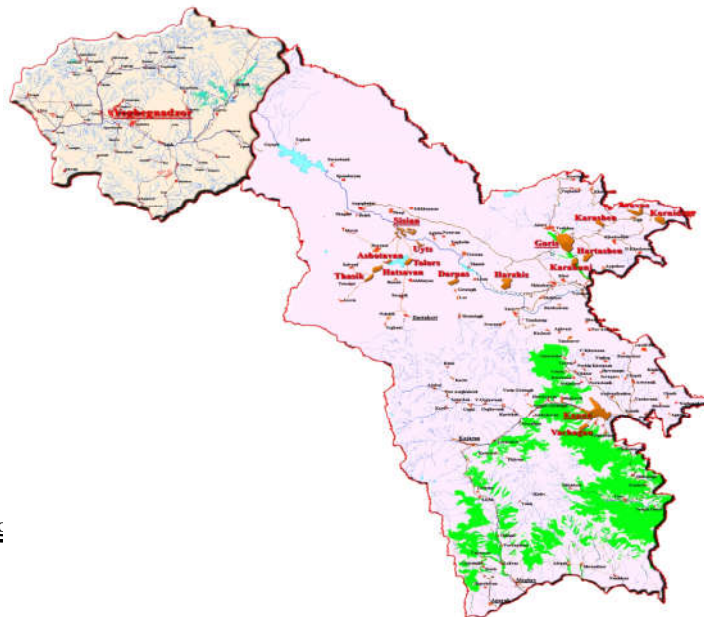
**LOT-3: DESIGN, TECHNICAL AND AUTHOR SUPERVISION OF THE WATER SUPPLY  
NETWORK AND SEWER SYSTEMS OF THE ARMENIAN WATER AND SEWERAGE  
CJSC SERVICE AREA - Contract № CIP II-P3-AWSC**

WORKING DESIGN- FINAL (REVISED) VERSION

**PACKAGE 3-B. VAYOTS DZOR AND SYUNIK MARZES IN RA**

**Sub-Package 3-B-II IMPROVEMENT OF W&W SYSTEMS OF  
GORIS, KAPAN TOWNS AND HATSAVAN,  
UYTS, TOLORS, TASIK, KARAHUNJ,  
HARZHIS, HARTASHEN, KARASHEN,  
ARAVUS VILLAGES**

**Book 3-B-II.3a ENVIRONMENT AND SOCIAL  
IMPACT ASSESSMENT**



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Yerevan,  
July, 2020





GOVERNMENT OF THE  
REPUBLIC OF ARMENIA



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IMPACT ASSESSMENT**

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# **PACKAGE 3-B. VAYOTS DZOR AND SYUNIK MARZES IN RA**

## **Sub-Package 3-B-II**

### **IMPROVEMENT OF W&W SYSTEMS OF GORIS, KAPAN TOWNS AND HATSAVAN, UYTS, TOLORS, TASIK, KARAHUNJ, HARZHIS, HARTASHEN, KARASHEN, ARAVUS VILLAGES**

#### **COVER OF THE DETAILED DESIGN**

- Book 3-B-II.1 - GENERAL PROVISIONS**
- Book 3-B-II.2 - TECHNICAL SPECIFICATIONS**
- Book 3-B-II.3a - ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT**
- Book 3-B-II.3b - OCCUPATIONAL HEALTH AND SAFETY GIUDELINES**
- Book 3-B-II.4 - DESIGN DRAWINGS**
- Book 3-B-II.5 - BILL OF QUANTITIES**
- Book 3-B-II.6 - COST ESTIMATES**

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## 1. EXECUTIVE SUMMARY

The project on “Design, Technical and Author Supervision of the Water Supply Network and Sewer Systems of the Armenian Water and Sewerage CJSC Service Area” is being implemented by the order of Water Sector Project Implementation Unit SI of SCWS, with the joint financing of the German Development bank (KfW), European Investment Bank (EIB), and EC Neighborhood Investment Facility (EC-NIF). The project is being implemented by SAFEGE SAS – JINJ LTD Consortium.

The goal of this project package is improvement of wastewater systems of Kapan and Goris towns, as well as drinking water supply systems of Sisan region’s Hatsavan, Uyts, Tolors, Tasik villages and Goris region’s Karahunj, Harzhis, Hartashen, Karashen, and Aravus villages in Syunik marz.

To achieve this goal, the following is planned:

- In Kapan town - to reconstruct approximately 1.4 km long building network and 3.1 km long sewer collectors.
- In Goris town - to reconstruct approximately 3.3 km long DN40÷DN160 (HDPE) polyethylene water lines and 3.55 km long DN160÷DN500mm sewage collectors, construct inlet lines of private houses and two-storey multi-apartment buildings with 7111 m total length, DN20-DN63 (HDPE) polyethylene pipes, 330 water metering and regulation chambers and 8 underground fire hydrants.
- In Harzhis village - to repair the water metering chamber of the inlet line supplying the village, the existing 250m<sup>3</sup> capacity DRR, to construct a chlorination station, sanitary zone fence for the DRR with 148.0 m perimeter, about 6.1 km long DN25-DN160(HDPE) polyethylene water lines (internal network), inlet lines of 178 private houses with 3420.0 m total length, DN20-DN40 (HDPE) polyethylene pipes, install 190 water metering and regulation chambers and construct 5 underground fire hydrant chambers.
- In Karahunj village - to construct approximately 6.5 km long DN32÷DN110 (HDPE) polyethylene water lines, inlet lines of 354 private houses and 5 public buildings with 5138.0 m total length, DN20-DN32 (HDPE) polyethylene pipes, install 363 water metering and regulation chambers and construct 6 underground fire hydrant chambers.
- In Hartashen village - to construct 1x150m<sup>3</sup> capacity DRR and implement sanitary protection zone, construct 0.11 km long DN100(St) steel water main, about 4.7 km long polyethylene water lines DN40÷DN110(HDPE), inlet lines of 157 private houses and 3 public buildings with 1690.0 m total length, DN20-DN32 (HDPE) polyethylene pipes, install 162 water metering and regulation chambers and construct 2 underground fire hydrant chambers.
- In Karashen village - to reconstruct the existing valve node of the inlet line, repair 50m<sup>3</sup> capacity DRR, replace the metal segment of the DRR supply water main (0.7 km) with DN75(HDPE) polyethylene pipes, reconstruct the sanitary zone, construct the intra-areal pipeline and valve chambers (3 pieces) in the DRR area.

- In Aravus village – to construct a new 50m<sup>3</sup> capacity DRR, including intra-areal pipelines, dry chamber, valve and pressure reducing chambers (3 pieces), sanitary zone fence; construct 134 m long DN90(HDPE) polyethylene pipeline supplying the DRR.
- In Tolors village – to construct an about 5.5 km long DN90(HDPE) polyethylene water main, a 1x100 m<sup>3</sup> capacity DRR with the sanitary zone fence, about 1.16 km long DN40÷DN110(HDPE) polyethylene water lines, inlet lines of 115 private houses and 4 public buildings with 981 m total length, DN20-DN32 (HDPE) polyethylene pipes, install 132 water metering and regulation chambers and construct 4 underground fire hydrant chambers.
- In Hatsavan village – to construct a new 50m<sup>3</sup> capacity DRR and dry chamber.
- In Tasik village – to construct an about 0.34 km long DN75(HDPE) polyethylene water main, a 1x100 m<sup>3</sup> capacity DRR with the sanitary zone fence, about 2.5 km long DN32÷DN110(HDPE) polyethylene water lines, inlet lines of 76 private houses and 2 public buildings with 1500.0m total length, DN20-DN40 (HDPE) polyethylene pipes, install 81 water metering and regulation chambers and construct 2 underground fire hydrant chambers.
- In Uyts village - to construct an about 2.14 km long DN110(HDPE) polyethylene water main, a 2.5x2.0, h=1.8m internally sized underground pump station, install 6 water metering and regulation chambers and construct 2 underground fire hydrant chambers.

Besides, the following is also planned:

- Repair or reconstruction of inlet line connection joints of all settlements or separate facilities supplied from Mukhuturyan-Goris-Kornidzor water main;
- Reconstruction of first and second pressure reducing chambers and decommissioning of the third one in Akner system.

Implementation of the water and sewerage systems improvement project will allow providing safe, reliable and sustainable water supply and wastewater removal services to the consumers of the above mentioned settlements (household (about 71150 residents) and other consumers), improve public health and protect water resources. As a result of the project the population will have an improved access to safe, reliable, and sustainable water and wastewater services and the latter will be managed on commercial principles and environmentally sound practices. Also, the sanitary condition of Kapan and Goris communities will be improved.

The Project will also support poverty reduction by (i) reducing the incidence of waterborne diseases and costs of medical care; (ii) improving the time poverty of women due to labor intensive housework such as water collection, which may allow them to be more engaged in social and economic activities; (iii) providing safer and more reliable water supply; and (iv) improving the quality of life of households in all the project settlements. The project will also contribute to climate change adaptation, reducing the impacts of climate risks on water resources.

The results of this report will serve as a basis for mitigating / preventing negative impacts on the environment, human health and climate during the construction works for improvement of drinking water supply and wastewater systems.

The section on the environmental, social and climate impact assessment has been developed based on the on site studies jointly with engineers, conversations with community leaders, and the available printed and online literature and materials.

## 2. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

### 2.1. POLICY AND LEGAL FRAMEWORK

The environmental protection is enshrined in the Constitution of Armenia, Article 12 on “Preservation of the Environment and Sustainable Development”, which sets forth:

1. The public power shall promote the preservation and regeneration of the environment and the reasonable utilization of natural resources governed by the principle of sustainable development and taking into account the responsibility towards future generations.

1. Everyone shall take care of the preservation of the environment.
2. The environmental protection is enshrined also in the RA legislation.

#### Law on environmental impact assessment and expertise

The Law on environmental impact assessment and expertise was adopted on 21 of June 2014. The Law regulates the sphere of state environmental impact assessment expertise in the Republic of Armenia, including trans-boundary environment.

The law defines the main provisions and principles of assessment and expertise as well as goals and objectives. According to the legislation, the purpose of the Environmental Impact Assessment is to predict, prevent, minimize, or eliminate possible harmful effects of implementation of the baseline document and the intended activity on the environment and human health.

According to the law, 48 types of activities in more than 18 areas of public and economic life are subject to environmental impact assessment and expertise, including the construction and operation of water facilities, reservoirs and dams, embankments, large canals, pumping stations and other water management structures, any actions related to underground water extraction, reconstruction and construction of wastewater treatment plants.

Within the framework of municipal water and wastewater systems improvement projects the possible environmental impacts during construction, operation, and after decommissioning, as well as in the conditions of emergencies are estimated.

#### The RA Law on Securing Sanitary-Epidemiological Safety of the Population

The general requirements for the sanitary-epidemiological safety of the population in the sphere of water supply and water use are defined by the RA Law "Securing Sanitary-Epidemiological Safety of the Population of the Republic of Armenia", other laws of the Republic of Armenia, a number of governmental decisions and inter-ministerial legal acts.

The Law on Securing Sanitary-Epidemiological Safety of the Population, enforced by the State Hygiene and Anti-epidemic Inspectorate of the Ministry of Health, regulates the quality and safety of supplied drinking water.

This law defines the legal, economic and organizational aspects of the sanitary-epidemiological security of the population of the Republic of Armenia, the authorities of the State on prevention

of the impact of dangerous and harming factors of the environment on the human organism and provision of favorable conditions for the vitality of the population and the future generations.

The general requirements for the provision of sanitary-epidemiological security of the population concerning public water supply and consumption are set forth under Article 16.

Article 23 of the Law serves a basis for the mandatory sanitary-hygienic expertise, which is carried out also for the facilities with chemical and biological discharges and outflows to the environment.

The requirements for the definition and regime of sanitary protection zones are also regulated by the Land Code of the Republic of Armenia, Government Resolution № 96 of 02 February 2002, the decision No.26 of 14 January 2002.

The sanitary rules and hygienic standards are registered and enforced by the RA Law on Legal Acts, as well as by the RA Labour Code.

#### Other RA Laws

The environmental impact of the works for improving water supply and wastewater systems is regulated by the RA Water Code, RA Land Code, RA Law on Specially Protected Nature Areas, other environmental laws and legal acts.

The requirements for population health safety in water supply and water use areas are defined by the following legal acts:

Sanitary protection zones for household drinking-water, water supply and water sources No.2-III-A2-2 sanitary rules and norms, 28.12.2002, which define the sanitary-hygiene and anti-epidemiological requirements for organization and operation of sanitary protection zones for household drinking- water supply sources,

Drinking water: Requirements imposed on water quality for centralized systems. Quality enforcement sanitary rules No. 2-III-A2-1 and norms, 28.12.2002, which defines the hygiene requirements for drinking-water quality, as well as the drinking-water quality enforcement rules provided to settlements.

## 2.2. CONVENTIONS AND INTERNATIONAL TREATIES

Convention on Environmental Impact Assessment in a Trans-boundary Context-Espoo, 1991).

According to the Convention, the parties undertake to mitigate, if not prevent in any way the transboundary harmful activities.

According to the Convention, the environmental impact assessment documentation shall contain the description of the proposed activity and its purpose, the reasonable alternatives to the proposed activity and also the no-action alternative, description of the environment likely to be significantly affected by the proposed activity and its alternatives, the list of mitigation measures to keep adverse environmental impact to a minimum, etc.

Protocol of Strategic Environmental Impact Assessment of the Convention on Environmental Impact Assessment in a Trans-boundary Context (Kiev, 2003).

The Protocol provides for Strategic environmental assessment (SEA) and the parties' commitment to this process at national and regional levels. According to the Protocol, the

programs and projects developed for the development of different sectors, and, where possible, the policy and legislation are subject to the SEA.

*Water and Health Protocol (1999) of the Convention on Protection and Use of Trans-boundary Watercourses and International Lakes, 1992*

The goals of the Protocol are to provide water quality which does not endanger human health, ensure access to drinking water for everyone, Implement sanitation and ecosystem protection measures.

*Aarhus Convention (1998)*

This Convention provides access to environmental information to the public, public participation in decision-making and access to justice for the public in the field of environmental protection.

Any information about drinking water and water supply should be available to the public.

The Paris Agreement for the UN Framework Convention on Climate Change (2017).

This Agreement will provide to keep the increase in global average temperature to well below 2 °C above pre-industrial levels at the expense of greenhouse gas emissions reduction. This will also significantly reduce climate change risks and impacts, as well as increase adaptability to climate change adverse impacts and contribute to confrontation of climate change without endangering food production.

*KfW Development Bank's Environmental Policy*

The principles of the KfW Development Bank's Environmental Policy are environmental and social compatibility as well as sustainability. These principles are included in Sustainability Guideline: Assessment of Environmental, Social, and Climate Performance: Principles and Process; (April 2016).

According to the Guideline, investment projects are classified into three categories “A”, “B” or “C”, according to the relevance of their potentially adverse environmental and social impacts and risks.

Category A: projects that may have diverse significant adverse impacts and risks on the environment and the social conditions of the affected population. Impacts and risks may potentially be significantly adverse because the complex nature of the project measure, the scale (large to very large), the sensitivity of the location (tropical forests, coral reefs, natural protection areas, wetlands, natural/near-natural forests, important cultural heritage sites) of the measure or the impacts and risks are irreversible or unprecedented. Projects that have significant transboundary impacts or relevance with regard to international treaties, or lead to a high consumption of resources, in particular soil, land or water, are also classified to category A.

Category B includes the projects that may have potentially adverse risks and impacts upon the environment and on the social conditions of those concerned. However, the impacts and risks may have a lesser extent than these of category A measures and can usually be mitigated through state-of-the-art mitigation measures or standard solutions. Typically, the potential impacts and risks of this category measures are limited to a local area, are in most cases reversible and are easier to mitigate through appropriate measures.

For category B FC measures, the need for and the scope, the priorities and depth of an ESIA have to be determined on a case by case evaluation. If it is expected that a Category B FC measures has single significant adverse environmental and social impacts and risks, an ESMS adapted to these impacts and risks, as described under Category A, is required.

Category C includes the projects that are expected to have no or only minor adverse environmental and social impacts or risks and if the implementation and operation of the measure does not require any particular protection, compensation or monitoring measures. However, category C measures should be monitored for any relevant changes over their life cycle.

Environmental screening has found out that in case of correct selection of the sites for the DRRs, chlorination stations, the water main routes, no irreversible negative impact is expected on landscape, flora and fauna in the area of water supply system improvement works that will be implemented in the project settlements. Besides, no adverse social and climate impact is anticipated, As a result, the project has been classified as a category B project, in accordance with KfW Guideline, Annex 1, Point 3. Use of water resources (e.g. large dams and other embankments, pumped-storage systems/power stations, irrigation and drainage projects, deep wells, water resource management and management of catchment areas, water supply, sea water desalination plants).

Under the national law, the RA Law on Environmental Impact Assessment and Expertise, the project gram is classified as category C. Under the legislation, the action initiator must submit a preliminary assessment application to the state authorized entity on the basis of which the authorized entity will provide an expert opinion at the initial stage of the examination within 30 business days.

### **2.3. ADMINISTRATIVE FRAMEWORK**

#### *The structure and capacities of state bodies implementing functions of water resource management and protection*

The functions of the protection, management and use of water resources in the Republic of Armenia are divided among two separate bodies.

The function of the management, maintenance and use of water systems is exercised by the State Committee of Water System (SCWS) functioning within the Ministry of Energy and Natural Resources.

The Armenian Water and Sewerage CJSC was functioning within the structure of the Committee and was operating, water and wastewater systems in 47 cities and 350 villages of the Republic of Armenia.

Yerevan Djur CJSC provided services to Yerevan and 39 adjacent settlements.

At present, one operator, "Veolia Djur" CJSC, operates in Armenia, which implements the operation of water supply and wastewater systems in all above settlements of Armenia.

The water resource management and protection function is currently being implemented by the Water Resources Management Agency of the Ministry of Nature Protection of the Republic of

Armenia (MNP) as a separate subdivision of the RA MNP, the main functions and tasks of which are:

- Establishment and management of freshwater and groundwater resource policy for the protection and effective use of water resources of the Republic of Armenia;
- Supporting and water resources management and protection within the National Water Policy and National Water Program;
- Ensuring implementation of scientific and technical fundamental and applied researches and introduction of results in the field of water resources management and protection;
- Ensuring implementation of the results of the wastewater permissible limit discharges, in accordance with the National Water Program,
- Ensuring the development of maps of aquatic ecosystem protection zones.

Since 2003, considerable investments have been made to increase the capacity of WRMA and other subdivisions of the MNP. The USAID funded the upgrading and equipment of the Environmental Monitoring Laboratory with modern devices and equipment. In addition, trainings for laboratory staff were held. Monitoring sites on the Hrazdan River, as well as the Republican Hydro-Meteorological and Environmental Monitoring Agency have been equipped. The Environmental Inspection SNCO is a part of the MNP, the main function of which is to carry out environmental impact assessment expertise for activities and concepts planned in Armenia.

Environmental protection and Mining Inspection Body of RA – EPMIB has a supervisory function in the field of environmental protection, natural resource utilization, reproduction and subsurface use.

The EPMIB 's functions are:

- Atmospheric air protection,
- Water resources use and protection;
- Land use and protection,
- Mining utilization and protection;
- Use and protection of fauna and flora;
- Hazardous materials, production and consumption waste,
- Providing and conducting the requirements and measures provided in the documents subjected to expertise,
- Administrative statistics.

Implementing supervisory functions and enforcement of responsibilities for sanitary-epidemiological safety of the RA population is the sphere of activity of the Health and labor Inspection body of the Republic of Armenia (HLIB). Among the goals and objectives of the Inspectorate are:

- Ensuring sanitary and epidemiological safety of the population of the Republic of Armenia.
- State hygiene and anti-epidemic control in the territory of the Republic of Armenia.
- Organizing sanitary-hygienic and anti-epidemic measures and preventive activities to prevent infectious (hazardous for the environment) and non-



infectious diseases and poisoning in the field of sanitary-epidemiological safety of population.

The functions of the Inspectorate include:

- Taking decisions on temporarily prohibiting the use of chemicals, perfumes , make-up products in the field of water use for drinking, economic, industrial, technical needs in cases when a risk for their hazardous effect on human health has been arisen before submission of the scientific and experimental substantiation of their safety by the developer or manufacturer;
- Taking decisions on temporarily prohibiting water use for drinking, household, economic, industrial and technical needs, if the quality of water does not comply with the sanitary-hygienic security requirements; implementation of administrative proceedings on RA Administrative Offenses.

### 3. PROJECT DESCRIPTION

This report was developed for improvement of wastewater systems of Kapan and Goris towns, as well as drinking water supply systems of Sisan region's Hatsavan, Uyts, Tolors, Tasik villages and Goris region's Karahunj, Harzhis, Hartashen, Karashen, and Aravus villages in Syunik marz, the design for which was implemented by SAFEGE SAS - JINJ LTD Consortium.

Rehabilitation of water supply and sewerage systems of the above mentioned settlements includes reconstruction and construction of water mains, DRRs, chlorination stations, construction and reconstruction of water distribution network, construction of pump station, reconstruction of sewerage system.

Adverse environmental and social impacts are possible during construction work, as well as in future operation and maintenance of water supply systems, which will be minimized or prevented due to good management. It is anticipated that adverse impacts on the environment and the social condition of the affected population will be minimal and will be of temporary nature during construction works. They can include vegetation cutting, soil erosion, air pollution, as well as pollution of soil and water resources by lubricants, chlorine compounds, household and construction waste, traffic congestion, open trench for a long time, etc.

During the construction works carried out in the residential areas, the community's population will be most vulnerable and the Contractor's actions should be aimed at minimizing the negative impacts on people.

In the operation stage, the adverse environmental impacts may be reduced conditioned by the proper implementation of operation rules.

The most essential one among the positive environmental impacts is the protection and sustainable use of water resources, protection of environment, as well as protection of Voghji and Vararakn rivers' ecosystems against pollution with domestic wastewater.

The social and economic effects as a result of water supply and wastewater system improvement are expected to be mostly positive, such as excluding potable and irrigation water mixing with household wastewater, minimization of water and land resources pollution risk, prevention and exclusion of infection disease agents penetration into potable water, water supply extension, providing sustainable water supply and rational water use.

Below the description of possible adverse impacts and mitigation measures required during different stages of water supply and wastewater systems rehabilitation project is provided.

#### ❖ *Design stage*

The design works on water and wastewater systems have been performed by SAFEGE SAS – JINJ LTD Consortium. The design documents include articles on climatic conditions, relief, natural soil types, hydrology and vegetation, as well as the requirements on obtaining the RA MNP and other Ministries' permissions. They include also corresponding environmental and social articles. The design package includes also the ESAP of the package. The Project

Consultant is in charge to follow the appropriate provisions of the RA Environmental and social legislation, as well as KfW Bank Guidelines and strategy requirements.

❖ *Construction stage*

The list of measures required to mitigate the adverse environmental impact during construction stage is provided in the ESAP table.

The operation in the construction stage must be carried out in accordance with the Operation Rules and Standards.

❖ *Operation stage*

In order to minimize the impact on the environment in the operational stage it should be carried out according to the rules and norms of operation of water and wastewater systems.

## 4. SCOPE OF WORKS

### 4.1. DESCRIPTION OF THE EXISTING SEWERAGE SYSTEMS OF KAPAN AND GORIS TOWNS

Kapan town is almost fully seweraged and the wastewater system is completely separated from rainwater drainage system. The wastewater network is a separate system that was built in 1958, mainly of 150-700mm ceramic, asbestos-cement and cast iron pipes. The total length of the network is approximately 50 km. Investments have not been implemented in the wastewater system. There are numerous accidents and clogging in the wastewater network. In different parts of the towns sewage is discharged into the Voghji river flowing through the town.

The town's WWTP is not operated for about 20 years and is not subject to reconstruction.

Goris town is fully seweraged, and the wastewater system is completely separated from rainwater drainage system, which was built in the 1970s. It is mainly made of 150-600mm ceramic and asbestos-cement pipes with a total length of about 40 km. A 300 m long, 600 mm collector was replaced in recent years, while accidents and clogging in the remaining part of the wastewater network are quite frequent. In various parts of the town sewage is discharged into the Vararak (Goris) river flowing through the town.

Goris town has never had a WWTP.

### 4.2. DESCRIPTION OF THE WATER SUPPLY SYSTEMS OF THE PROJECT SETTLEMENTS

Hatsavan village is supplied by gravity, from 19.5 km long Mukhuturyan-Tasik water main fed from the Mukhuturyan-Goris-Kornidzor system. The water main is made of steel and polyethylene pipes. The high pressures in the main cause frequent accidents. There is a water metering node built at the water mains' connection point, where water meter is missing.

From Mukhuturyan-Tasik water main water is supplied through about 860 m long polyethylene pipeline to the village's 18.0 m<sup>3</sup> capacity r/c reservoir. Its position is not dominating over the whole village and does not provide the required pressures to supply water to higher located districts. The DRR is not fenced.

The distribution network of the village is of 2.4 km total length, made of 25-110mm polyethylene pipes. The distribution network is in good condition. Each customer has an individual metering chamber with its water meter.

The village has 24-hour water supply.

Uyts village is supplied from the DRRs of Sisian town, which are fed from Shake spring intakes at certain distance from each other. The pipeline supplying the distribution network of the village is fed from Sisian town's distribution network. It is made of polyethylene pipes and is in good condition. However, the higher located districts have water supply problems, especially in summer. There is a 100m<sup>3</sup> DRR in the village, which is in emergency condition, does not operate and is not fit for further operation.

The distribution network has a total length of 3.65 km, made of 25-63mm polyethylene pipes. It is reconstructed and is in good condition. Each customer has an individual metering chamber with its water meter.

**Tolors village's** water supply is carried out from 3 captured springs called "Bats Chiman", which are located at a certain distance from each other and have separate fenced sanitary protection zones in good condition. The spring intakes are small r/c structures in satisfactory condition. The quality indicators of water are low and the water does not meet the state drinking water standards. Water disinfection in the system is implemented in the spring intakes, from time to time, with capsules.

Water is supplied from the springs to the water distribution network through 2.1 km long water main, which was built in 1974; it is made of cast-iron and steel pipes and generally is in poor condition.

There is a 200 m<sup>3</sup> capacity r/c DRR in the village, which is not appropriate for further operation. The main part of the distribution network, 1.55 km, has been reconstructed and is in good condition. The remaining part of the distribution network, about 950.0 m is in emergency condition and is subject to reconstruction. The village does not have a metering system and the customers are not charged for water supply.

The water supply is carried 24-hours a day.

The system operation is carried out by the local government.

**Tasik village's** water supply is carried out from 2 different springs. The springs are not captured and water is collected from open surface. The spring flows have seasonal variations, quality indicators of water are low and do not meet the state drinking water standards. From the springs water is supplied to the DRRs of the village through 2 different water mains, which were built in 1973-1978. They are made of steel pipes and are in dilapidated condition.

There are two DRRs in the village (150m<sup>3</sup> and 50m<sup>3</sup>) which were built in the 1980s. At present they operate, but are in deteriorated condition.

The DRRs are located at about 200 m distance from each other, and not far from the fenced area of the village cemetery. They do not have fenced sanitary protection zones.

Water metering and disinfection are not carried out in the external water supply system.

The distribution network of Tasik village is currently supplied from 2 different springs. The distribution network, about 2.6km is in poor condition. About 300.0m has been reconstructed with big violations of norms and also needs replacement. Metering is not implemented in the distribution network and the customers are not charged for water supply.

The system operation is carried out by the local government.

The water supply is carried 24-hours a day.

**Goris town's** water supply is implemented from the Mukhuturyan-Goris-Kornidzor system by gravity.

Goris town receives water from the distribution node near "Zanger" monument, through a pair of 2.0 km long water mains. The distribution node is in poor condition (individual production enterprises or small residential districts have laid water lines, which join the distribution node irregularly, and complicate its management and operation) and needs reconstruction.

The above mentioned water mains supply three groups of DRRs in the town (2x500m<sup>3</sup>, 1x1000m<sup>3</sup>, 1x500m<sup>3</sup> 1x1000m<sup>3</sup>), which in turn supply the central part of the town's distribution network. The DRRs are in satisfactory condition

From the 1x1000 m<sup>3</sup> capacity DRR supplies the north-eastern part of the distribution network.

The DRR is in generally satisfactory condition.

In the north-eastern part of the town there are 2x250 m<sup>3</sup> capacity DRRs, which do not operate presently.

The total length of the distribution network is about 67 km, made of cast iron, steel and polyethylene pipes. The main part of the network was built in the 1950s, and its 31 km is repaired.

The town's distribution network is not clearly zoned, and as a result, there are higher than required pressures in the distribution network. The pressures are controlled mainly by valve nodes.

The distribution network in the central part and the water lines in the districts of high-rise buildings in the north-western part of the town (about 16 km) are in poor condition. The DRRs need repair.

There are not metering nodes in the distribution network.

In the private sector's and other parts customers' individual water meters are installed.

Water supply to the town is carried out round the clock.

**Karahunj village's** water supply distribution is carried out from Mukhuturyan-Goris-Kornidzor system.

The total length of the water distribution network is about 6.2km. It is totally deteriorated, there are numerous accidents. The main part of the village has 24-hour water supply, and the Verin Tagh district water is supplied 4 hours a day. There are not metering nodes in the distribution network, but the customers have individual meters.

**Harzhis village's** water supply distribution is carried out from Mukhuturyan-Goris-Kornidzor system. Water is supplied from the mentioned water main to the village's reservoir through a 2.5 km long water main, which is in good condition.

The 250 m<sup>3</sup> capacity DRR of the village is a r / c structure. It is not in a good condition and needs reconstruction. There is another 150 m<sup>3</sup> capacity DRR in the sanitary zone area which is also supplied through a separate water main from Mukhuturyan-Goris-Kornidzor water main.

Disinfection of water supplied to Harzhis village is not implemented at present.

The water distribution network of Harzhis village is supplied from the DRR about 1.0 km long 100 mm steel pipeline. This pipeline is in a bad condition.

A distribution node was built in recent years, and thanks to it water supply in the village became 12-24 hours in different streets.

About 4.4 km water lines of the distribution network is fully deteriorated, and there are many accidents.

There are not metering nodes in the distribution network, but the customers have individual meters installed in their houses.

**Hartashen village's** water is supplied from Mukhuturyan-Goris-Kornidzor water main through a 1.55km long 100-150 mm steel and cast iron pipeline

About 1.0 km segment of this pipeline is in a bad condition. The water distribution network's total length is about 3.3 km. It is fully deteriorated and there are many accidents.

There are not metering nodes in the distribution network, but the customers have individual water meters installed in their houses.

The village has 24-hour water supply.

**Karashen village's** water is supplied from Mukhuturyan-Goris-Kornidzor water main through a 850.0 m long steel and polyethylene main, the 650.0 m steel segment of which is in a bad condition. Through the water main water is given to the existing 75 m<sup>3</sup> capacity r/c DRR of the village. The DRR and sanitary zone fence need repair.

Karashen village's water distribution network is supplied from the DRR. The total length of the distribution network is .2.2 km, made of 32-75 mm polyethylene pipes presently in good condition.

There are not metering nodes in the distribution network, but each customer has an individual metering chamber with its water meter.

The village has 24-hour water supply.

**Aravus village's** water is supplied from Mukhuturyan-Goris-Kornidzor water main through a 3.0 km long steel water main. Through this water main water is given to the existing DRR of the village. The DRR is a 50m<sup>3</sup> capacity r/c structure and is in deteriorated condition. The sanitary zone of the DRR is fenced.

Aravus village's water distribution network is mainly supplied from the DRR. The customers at higher altitudess are supplied directly from the water main feeding the DRR. The total network length is 1.5 km; it is implemented of 32-63mm polyethylene pipes.

There are not metering nodes in the distribution network, but each customer has an individual metering chamber with its water meter.

The village has 24-hour water supply.

#### **4.3. DESCRIPTION OF THE PROPOSED REHABILITATION WORKS**

This package of DD envisages repair or reconstruction of the connection junctions of the inlet lines of all settlements or individual facilities fed from the Mukhuturyan-Goris-Kornidzor water main.

In some connection joint of inlet lines pressure regulating valves are planned. Technological equipment and devices are planned to be completely replaced in all chambers.

In the chambers in satisfactory condition, renovation works have been envisaged (floor repairs, replacement of manholes with r/c high manholes and installation of metal ladders), while the chambers in destroyed or ruined condition are planned to be demolished and new round or rectangular chambers are to be constructed instead.

*In Akner-Goris system* the following is planned: replacement of manholes of Akner N1 PRC and water metering chambers with precast r/c high manholes, diking, reconstruction of the destroyed

part of the sanitary protection zone and replacement of metal gate, reconstruction of Akner N2 PRC, decommissioning of Akner N3 PRC.

*In Goris town* the following is planned: construction of about 3.3 km long DN40-DN160(HDPE) polyethylene water lines, construction of individual inlet lines for private houses, multi-apartment and public buildings with a total length of 7111 m (DN20-DN90 (HDPE) polyethylene pipes), with installation of 330 water metering and regulation chambers, 8 underground fire hydrant chambers, reconstruction of about 3.55km sewage collectors in the wastewater network with DN160-DN500 (GF) polyethylene corrugated pipes.

*In Kapan town* reconstruction of about 1.4 km of building sewerage networks and about 3.1 km collectors is planned.

*In Harzhis village* the following is planned: repair of the water metering chamber of the inlet line supplying the village, the existing 250m<sup>3</sup> capacity DRR, construction of a chlorination station, sanitary zone fence with 148.0 m perimeter, construction of 6.1 km long DN25-DN160(HDPE) polyethylene water lines (internal network), individual inlet lines for 178 private houses with a total length of 3420.0m, made of DN20-DN40 (HDPE) polyethylene pipes, installation of 190 water metering and regulation chambers, construction of 5 underground fire hydrant chambers.

*In Karahunj village* the following is planned: construction of 6.5 km long DN32-DN110(HDPE) polyethylene water lines, inlet lines for 354 private houses and 5 public buildings, with a total length of 5138.0m, made of DN20-DN32 (HDPE) polyethylene pipes, installation of 363 water metering and regulation chambers; construction of 6 underground fire hydrant chambers.

*In Hartashen village* the following is planned: construction of 1x150m<sup>3</sup> DRR and implementation of sanitary zone, construction of about 0.11km long DN100(St) steel water main supplying the DRR, about 4.7 km long DN40-DN110(HDPE) polyethylene water lines, inlet lines for 157 private houses and 3 public buildings, with a total length of 1690.0m, made of DN20-DN32 (HDPE) polyethylene pipes, installation of 162 water metering and regulation chambers, construction of 2 underground fire hydrant chambers.

*In Karashen village* the following is planned: reconstruction of the existing valve node of the inlet line, replacement of the metal part of the water main feeding the DRR (0.7 km) with DN75 (HDPE) polyethylene pipes, reconstruction of sanitary protection zone, construction of intra-area pipelines and valve chambers (3 pieces) in the DRR area.

*In Aravus village* the following is planned: construction of a new 50 m<sup>3</sup> DRR, including intra-area pipelines, dry chamber, valve and pressure regulation chambers (3 pieces), sanitary protection zone fence, construction of 134 m long DN90(HDPE) polyethylene pipeline supplying the DRR.

*In Tolors village* the following is planned: construction of 5.5 km long water main with DN90(HDPE) polyethylene pipes; a 1x100m<sup>3</sup> capacity DRR with sanitary zone fence, about



1.16 km long DN40÷DN110(HDPE) polyethylene water lines, inlet lines of 115 private houses and 4 public buildings with 981.0 m total length, from DN20-DN32(HDPE) polyethylene pipes, installation of 132 water metering and regulation chambers and 4 underground fire hydrant chambers.

*In Hatsavan* village construction of a new 50.0m<sup>3</sup> capacity DRR and a dry chamber is planned.

*In Tasik village* the following is planned: constructon of water main from about 0.34 km long DN75(HDPE) polyethylene pipes, a 1x100m<sup>3</sup> DRR with sanitary zone fence, about 2.5 km long DN40÷DN160(HDPE) polyethylene water lines, individual inlet lines for 76 private houses and 2 public buildings with a total length of 1500.0m, made of DN20-DN40 (HDPE) polyethylene pipes, installation of 81 water metering and regulation chambers and construction of 2 underground fire hydrant chambers.

*In Uyts village* the following is planned: constructon of water main from about 2.14 km long DN110(HDPE) polyethylene pipes, a 2.5x2.0, h=1.8m internally sized underground pumping station, 6 water metering and regulation chambers and 2 underground fire hydrant chambers.

The brief description of the planned works is provided in Table 1 below.

Table 1 Brief description of the planned works

Works	M/U	Settlements																																
		Goris			Kapan			Hatsavan			Uyts			Tolors			Tasik			Harzhis			Karahunj			Hartashen			Karashen			Aravus		
		Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road			
Construction / reconstruction of sewage collectors and building network	km	3.55			4.5																													
		3.024 0.076 (concrete tiles)	450.0																															
Reconstruction of water mains	km										2.1			5.5			0.34									0.11			0.7			0.13		
											0.135	1.965			3.3 Asphalt road side	2.2		0.34								0.11					0.7	0.13		
Construction / reconstruction of internal network, including inlet lines of multi-apartment buildings, public facilities and private houses	km	10.7												2.1			4.0			9.5			11.7			6.4 (1.0 Asphalt road side)						0.13		
		8.94 0.010 (tile cover)	1.750										1.6	0.5			4.0			8.2	1.3	2.0	9.7			6.4					0.130			
Construction / reconstruction of DRR	piece							1						1			1			1						1			1			1		
Construction / reconstruction of pump station	piece										1																							
Construction / reconstruction of chlorination station	piece																			1														
Construction of water metering and regulation chambers	piece	330									6			132			81			190			369			167			3			3		
Construction of fire hydrants	piece	8									2			4			2			5			4			2								

After completion of works in asphalt-covered streets in good condition, the cover to be rehabilitated shall be of the same quality. The excess soils and construction waste of the excavated trenches shall be removed to the landfill allocated for the communities, at distance mentioned in the document issued by community head.

## 5. BASELINE ENVIRONMENTAL DATA

### 5.1. BASELINE ENVIRONMENTAL CONDITIONS

**Kapan town** is the regional center of Syunik region. It is located in the south-east of the country, at 320 m south-east of Yerevan, on the Voghji river bank, on the northern foot of Mount Khustup, at 705-1050 m absolute elevations.

The number of population in Kapan is 42600 (the number of population in all settlements is provided as of 01.01.2017 and the data are taken from the web site of the RA National Statistical Service).

The town is located in the north of the subtropical climatic zone, where hot and dry air masses penetrating from the south are active in summer, and the cold air from the north in winter. The influence of the Caspian Sea is also significant. The landscape is rough, the altitude fluctuations exceed 300m.

The average multi-year air temperature in January is 0° C, in July 23-24 ° C. The average multi-year annual air temperature is 11, 5°C. Absolute minimum temperature is -27°C, absolute maximum is +39°C.

The multi-year annual average precipitation is 544 mm (minimum annual average is 380 mm). Approximately 55% of the total precipitation is in March-June and 17% in July-September. The most precipitation is in May, and the lowest precipitation is in December and August. Strong winds are rare.

The maximum wind speed is 15m/s. The winds of the south-eastern and eastern directions, with the average speed of 1-3m/s are dominating.

**Goris town** is located in Syunik region, on the bank of Varakak (Vorotan) River, at about 240 km distance from Yerevan.

According to the data of RA National Statistical Service the number of population in Goris as of 01.01.2017 is about 23100.

The climate here is temperate mountainous, with mild snowy winters and warm summers. The annual duration of the sunshine is more than 2100 hours, the number of cloudy days is 59. The average temperature in January is -7, 7 ° C, and in July is 22 ° C.

The maximum annual precipitation is 700mm.

The maximum wind speed is 18 m/s. E: The winds of the south-eastern and eastern directions with the average speed of 1-3m/s are dominating.

**Hatsavan, Uyts, Tolors, Tasik villages** are located in Sisian region of Syunik marz. From the point of view of administrative governance, these villages are now enlarged and are the communities of the Sisian large community.

**Hatsavan settlement** is located at 1775 m above sea level; it is a settlement located on the left bank of the river Zohajur in the Vorotan basin. It is located 112 km north-west from the regional center.

The number of population in the settlement is about 270 people.

**Uyts settlement** is located 2 km south-east of Sisian town, on the right side of the Sisian river, not far from the river mouth. It is located on mild mountain slope, covered with fruit trees and larvae.

The number of population in the settlement is 547 people.

**Tolors settlement** is located 6 km south of Sisian town, on the bank of the Tolors reservoir. It is located on the fertile plain on the left bank of the Ayriget, a right-side tributary of the Sisian river.

The number of population in the settlement is 450.

**Tasik settlement** is located at 13 km distance from Sisian town. It is a border, mountainous settlement located at 1,740 m above sea level.

The number of population in the settlement is 292.

Since the climatic conditions are not characterized separately for rural areas, the climatic conditions of Sisian region is described below, which is characteristic of the aforementioned villages.

The Sisian region is located in the northern part of Zangezur. It has a mountain surface, and up to 3552 m (Ishkhanasar) height. The western parts of the Zangezur Range and the volcanic plateau of Karabakh are in this area. Mountain-steppe and mountain-valley landscapes are common.

Winter in this region is long lasting. The stable snow layer is long for 3-4 months. The average January temperature is  $-4.8^{\circ}\text{C}$ , the average annual one is  $6.9^{\circ}\text{C}$ , the absolute minimum is  $-34^{\circ}\text{C}$ .

Winter weather is characterized by sunny days and considerable number of windless days. Moderately frosty (when the average air temperature is  $-12.5^{\circ}\text{C}$ ) and considerably frosty (when the average daily air temperature is  $-21.5^{\circ}\text{C}$ ) weather is predominant.

Spring is cool, long lasting (2-3 months), moderately cold.

Summer is moderately hot, lasts 2-3 months, with prevailing clear weather. The average July temperature is  $17.9^{\circ}\text{C}$ , absolute maximum is  $36^{\circ}\text{C}$ . In some years the weather is dry in summer.

The autumn is cool, it is characterized as steady, sunny and windless.

The maximum annual precipitation is 392 mm.

The pressure of the snow cover reaches  $70\text{ kgf} / \text{m}^2$ .

Maximum soil freezing depth is 92 cm.

**Karahunj, Harzhis, Hartashen, Karashen, and Aravus villages** are located in Goris region of Syunik Marz. From the administrative point of view, the villages of Karahunj and Hartashen are located in Goris enlarged community, and the villages of Karashen and Aravus are in Tegh enlarged community, and the village of Harzhis is in the enlarged community of Tatev.

**Karahunj settlement** is located 4 km south of Goris, at the intersection of the rivers Vararak and Karahunj, at an altitude of 1250 m above sea level.

The number of population in the settlement is 1370.

**Harzhis settlement** is located 24 km far from Goris on the left bank of the Vorotan River, at about 1700-1730 m above sea level.

Harzhis is surrounded by volcanic hills and mountains in the east, north and west. The number of population in the settlement is 1014.

**Hartashen community** is located on a plateau at about 1350-1480 m above sea level, 14 km south-east of Goris.

The number of population in the settlement is about 750.

**Karashen community** is located 7-8 km north-east from Goris, on the left side of Goris-Stepanakert highway, on a canyon slope, surrounded by fertile fields.

The number of population in the settlement is 558.

**Aravus community** is located 22 km north-east from Goris, on the left side of the Goris-Stepanakert highway, on a mountain slope, at about 1350-1390 m above sea level.

The number of population in the settlement is 202 people.

The settlements are located in Goris region, in the southeastern part of the country, in Zangezur, on Syunik volcanic plateau and on the northern branches of Bargushat mountain range.

Climate is diverse, with clearly expressed vertical zones. From bottom to top there are a number of climate types, with mild winters, from moderate warm to severe winters. The average air temperature in January ranges from  $-2^{\circ}\text{C}$  (lower located parts) to  $-10^{\circ}\text{C}$  (at the top of Ishkhanasar) and in July - from  $22^{\circ}\text{C}$  to  $10^{\circ}\text{C}$ , respectively.

The annual precipitation is 500-800 mm, with the maximum - in May and June.

Climatic conditions in Syunik Marz are remarkable for their diversity. The following climatic zones have been formed here: dry subtropical climate, moderately warm climate with mild winters, temperate climate with mild winters, temperate relatively wet throughout the year, temperate climate with mild summers and relatively cold winters and moderately cold climate with short cool summers and cold winters.

The climatic analysis of Syunik Marz has shown that the air temperature in the Marz has generally increased by  $0.7^{\circ}\text{C}$  -  $0.9^{\circ}\text{C}$ , with the average annual temperature growth in all stations recorded in March, with  $2.7^{\circ}\text{C}$  in Goris,  $2.6^{\circ}\text{C}$  in Kapan and  $2.4^{\circ}\text{C}$  in Meghri. Though there is a tendency of decreasing precipitation in the long term, however, an increase in monthly precipitation is observed by 10- 30% in Meghri and Kapan in July-October period. Assessment of the impact of climate change on water resources has not been implemented for the Syunik Marz, but based on the assessment of precipitation change, it can be concluded that significant negative impact is not expected.

## 5.2. GEOLOGY OF THE STUDIED AREA

Most of the Syunik Marz's territory is composed of cliffs, mountain ranges and deep canyons, through which mountainous streams flow. The biggest river is the Vorotan River. Syunik's average altitude is 2,200 m above sea level. The highest peaks are Kaputjugh (3904), Tsg huk (3581), Mets Ishkhanasar (3550), etc.

There are folded- fragmentary severely fragmented mountains and volcanic plateaus and terraces that are made up of different rocks. Volcanic and volcanic-sedimentary rocks take part in the

geological structure of the region, including porphyrite, tuffabreccia, etc, volcanic formations of Pliocene Miocene age. The mentioned strata are covered by alluvial formations of Quaternary age, such as clay, sand and boulder soils. In individual cases their thickness exceeds 20.0 m.

From the hydro-geological point of view, groundwater is widespread in the region. According to water bearing features, the rocks and soils in the region are divided into 3 groups:

- water bearing complex of deluvial-proluvial sediments;
- complex of Quaternary lava sediments;
- complex of Metamorphic and igneous rocks.

From seismotectonic point of view the region is located in Syunyats highland, at higher altitudess.

Among dangerous physical-geological processes and phenomena are landslides, collapses, mudflows, stone collapses, floods, side and riverbed erosion, surface washing, local flooding, etc.

### 5.3. BIODIVERSITY

The geographical location, the unique climate and the diversity of plants of Goris basin have created a comfortable environment for the fauna. Intense bank erosion processes have created alpine meadows. Steppe landscapes have been formed on volcanic plateaus at up to 2200 m altitude. Soil cover is represented by carbonate and delimed black soil. Forest and forest-steppe landscapes, with brown forest soils are mostly found on the northern slopes of the Bargushat mountain range and in the valley of Vorotan. Insignificant forest strips have also been preserved in the mid-stream of the Goris River.

#### *Flora*

The area soils are mostly mountain brown, mountain black, mountain-forest brown soils. Mountain brown soils have been formed in dry climatic conditions. Mountain black soils have lumpy-granular structure.

The vegetation is mainly of forest type, with broad-leaved forests, with *Fagusorientalis* Lipsky and *Quercus iberica* Stev, xenophile forest - *Juniperus polycarpus* C and foliage mixed - *Paliurus spina-christi* Mill species.



*Quercus iberica* Stev



*Juniperus Polycarpus* C. Koch

Steppe vegetation is also common, with cereal species, valley-steppe vegetation *Festuca versicolor* Tausch and in high mountainous regions also *Campanula tridentata* Schreb species. In mountainous-steppe zone *Ziziphora*, *Nepeta*, *Salvia*, *Teucrium*, *Scutellaria*, *Artemisia* and other species are common.



*Ziziphora clinopodioides*



*Salvia officinalis*



*Teucrium capitatum*



*Astragalus aureus*

In black soil areas cultivation of cereals, fodder crops, potato, tobacco, as well as fruit trees is developed.

Also species of wild medical herbs are dominating, in particular, *Rhamnus cathartica*, *Origanum vulgare*, *Punica granatum*, *Rhus coriaria*, *Digitalis ferruginea*, *Cotinus coggygia*, etc.

There are not Red Book species in Sisian region. The species in Goris and Kapan regions included in the Red Book area *Adiantum cappilus-veneris*, *Inula aucherana*, *Ophrys corraloides*, *Zelcova carpinifolia*, *Trifolium sebastianii*, *Paeonia tenuifolia*, *Tulipa confusa*, *Dactylorhiza cataonica*, *Orchis purpurea*.

### ***Fauna***

Among fauna representatives are *Felis chaus*, *Histryx indica*, European buckthorn, wild sheep (mouflon), brown bear, jackal, forest cat, rabbit, wild pig, *Anas platyrhynchos*, partridge.





*Felis chaus*



*Ovis orientalis gmelinii*



*Histryx indica*



*Anas platyrhynchos*

Among the species registered in the Red Book area *Rhinolophus ferrumequinum* Schreb, *Rhinolophus hipposideros* Bechstein and *Rhinolophus mehelyi* Matschie, and *Crocidura armenica* Gureev.



*Rhinolophus mehelyi* Matschie



*Crocidura armenica* Gureev

### ***Biodiversity of the area subject to immediate impact***

In the area subject to immediate impact, xerophyte forest, steppe and forest plant species have been discovered, where mostly *Fagus*, *Oak*, *Carpinus* and *Juniperus*, as well as cereals and herbaceous species are dominant. Rare and disappearing species, as well as species registered in the Red Book have not been found in the area of immediate activity. Among the birds are *Accipiter brevipes*, *Circaetus gallicus*, *Lyrurus mlokosievicsi*, *Merops superciliosus persicus*, *Monticola saxatilis*, *Monticola solitarius*.

There are three types of amphibians: *Rana ridibunda*, *Rana macrocnemis* and *Hyla savignyi*, as well as 19 types of reptiles.

However, the project implementation areas do not include the areals of these animals and any hazards or disruptions during the construction works will not be caused to them.

### ***Specially protected natural areas***

Among the specially protected natural areas, the closest one to the project area is the Goris sanctuary, one of the 26 sanctuaries of the Republic of Armenia. It was founded in 1972 and has an area of 1850 ha. It is located in the Syunik Marz, in the Vorotan river basin, at 1400-2800 m above sea level. It was created for the protection of forest landscapes and fauna (buckwheat, spotted deer, gray bear, Caucasian blackcock).

However, this area is beyond the direct impact zone of the project.

It is located 10 km away from Goris town and cannot be affected by the project implementation.

### **Water ecosystems**

The area under study is rich in water resources, and all the rivers belong to Araks river basin. Voghji, Vararakan, Sisian and Shaki rivers are located directly in the project impact zone, as they flow through settlements. Voghji river flows through Kapan town, Vararakan river – through Goros, Sisian river – through Uyts village.

Voghji is the second river in its length in Zangezur. It is 85km long, starts from Kaputjir mountain's tops and flows mostly through forest covered gauge. Enclosed mostly in granite rocks, the very narrow Voghji valley at some places turns into abyss in which the strong river snatches huge rocks, crushes them and carries to Araks river. Voghji is one of the most polluted rivers in Armenia. It is polluted with mining, industrial and household wastewaters. The natural ecosystem is disturbed in the river.

Vararakan river is Vorotan river's left tribute. It starts from Syunik highland's Mets Ishkhanasar mountain's south eastern slope from 2750m altitude. It is 29km long, the feeding is mixed (76%) underground, (24%) snow-rains, flooding in April-May. The waters are used for irrigation purposes.

Vararakan river is polluted with the wastewaters and household waste from Goris town and surrounding villages. The four SHPPs constructed on the river have enclosed about 20% of the water into pipes, and this has resulted to crisis situation.

Sisian river is the right tribute of Vorotan. It starts from Zangezur Mount range Shahaponk mountain top's north slope, from 3040m altitude. The river is 33km long, the catchment basin is 395km<sup>2</sup>. In the upper and middle part the river flows through V shaped valley, then through a vast hill valley where the Tolors reservoir is constructed. The feeding is mixed with rain-snow waters dominating (71%), flooding in March-June during which about 72% of the annual flow is formed. Sometimes there are overflows. The waters are used for irrigation and power industry purposes.

Shaki is the left tribute of Vorotan river, starts from Syunik highland's Tsghuk mountain top's south eastern slope from about 2560m altitude. It is 17km long, water catchment basin is 16,4km<sup>2</sup>. The valley is U shaped. The feeding is mostly from snow melts and rains (64%),

flooding in April-June. There are springs in the valey, waterfalls on the river, the highest of which is the Shaki waterfall (18m). Shaki TPP was constructed on the River (1936).

During the construction works all the rivers are subject to disturbance, as there will be constructed/reconstructed span water lines and sewage lines along their banks or over the rivers.

#### ***Historic-cultural monuments***

The project settlements are rich with historical monuments. There are many medieval monastic complexes, ancient churches, sanctuaries, chapels, cave houses, pagan shrines, cuneiform inscriptions, medieval castles, fortresses and monuments, khachkars (cross-stones), cemeteries of 10-18<sup>th</sup> centuries, Bronze Age sepultures. Since all historical and cultural monuments are registered and visible in communities, the water and wastewater systems have been designed in the design stage, maintaining their integrity.

There is no direct negative impact on these monuments during the implementation of the project.

## 6. ENVIRONMENTAL, SOCIAL AND CLIMATE IMPACTS

As a result of the works aimed at the improvement of wastewater systems of Kapan and Goris towns, as well as drinking water supply systems of Sisan region's Hatsavan, Uyts, Tolors, Tasik villages and Goris region's Karahunj, Harzhis, Hartashen, Karashen, and Aravus villages in Syunik marz, the expected positive environmental, health and social effects are as follows:

- water resource protection and sustainable use,
- excluding mixing of drinking, irrigation and sewerage water,
- preventing, excluding penetration of infectious agents in drinking water;
- reduction of drinking water pollution hazard,
- providing high drinking water quality,
- improvement of health condition of population,
- reduction of water losses,
- increasing duration of water supply to population,
- introduction of water metering system,
- increasing water consumption efficiency,
- improvement of sanitary and hygienic conditions of the population,
- exclusion of environmental pollution with household wastewater,
- prevention of degradation of water and land ecosystems.

The activities carried out under this package will have a noticeable positive impact on the social situation of the population. It will directly improve the quality of life of communities' population by providing sustainable and reliable water supply and wastewater disposal, saving water resources for about 71150 people.

As a result of the introduction of water metering system, reduction of leakage, the amount of water supplied will be increased and the amount of water used will be reduced (the collection of fees for the used water will result in efficient water use and water loss reduction, on the other hand, when people have 24-hour water supply, they will not have to store large quantities of water, which is not used and freshen every day), increasing the flexibility of water resources to climate change.

### 6.1. ENVIRONMENTAL AND SOCIAL RISKS ASSESSMENT

Initial environmental examination (IEE) revealed that the implementation of works aimed at water supply and wastewater systems improvement in the project settlements will not have irreversible harmful effects on landscapes, flora and fauna in the works implementation area.

The routes and places of structures for the newly designed W&W systems were selected, by-passing protected nature conservation areas and important landscapes, as well as privatized areas, aimed at minimizing the environmental and social impacts of the project; the shortest possible routes were selected to avoid increasing of the cost of construction.

The project's environmental risks are primarily related to the construction of water pipelines passing through field roads, which, as shown in Table 1, are present during the reconstruction/construction of water mains of Tolors (2.2km), and Karashen (0.7km) villages. During these activities it is possible to physically injure grasslands, arable lands with construction machinery, materials and equipment.

It is also possible the pollution and disturbance of river ecosystems during the reconstruction works of Goris and Kapan towns' sewage collectors, the construction works of water mains in Goris and Uyts communities, as well during the rehabilitation of the last 230m of Mukhutyryan-Tasik water main.

During the construction works the about 545m of wastewater network in Goris town passes through the streets parallel Vararakn river at a distance of 10-20m from the river, and the about 320m of the distribution etwork passes through the streets parallel the river and in one place spans acrosses the river.

In Kapan town, in the streets parallel to Voghji river's two banks it is planned the reconstruction of about 2.62km long sewage collectors. Uyts village water main crosses the river in two places, and the about 350m of the main passes through the road parallel Sisian river.

Potential risks during replacement of water supply networks within the settlements and construction of individual houses' inlet lines are the safety of residents and workers/staff, disruption of pedestrian and traffic roads, air pollution with dust.

The probable negative effects might be mainly caused by construction works implementation, and expected to do limited damage and be temporal.

The following negative impacts are also expected during the construction works:

- Air pollution
- Soil erosion
- Pollution of environment and water resources with construction and household waste
- Pollution of soil and water resources with fuels and lubricants
- Water and soil pollution with chlorine
- Water and soil resources pollution with household wastewater
- Noise and vibration
- Damage to arable lands and grasslands
- Temporary disturbances to roads to the arable lands of the communities
- Disturbance of road and pedestrian roads within the communities and increase of traffic load
- Infringement of occupational health and safety requirements for staff
- Ignoring safety measures for residents.

To minimize or prevent the negative impacts, mitigation measures were envisaged and an Environmental and Social management and monitoring plan (ESMMP) was developed, which should be followed by the contractor, controlling and supervision units.

The Environmental and Social Management Plan (ESMP) is an integral part of the environmental assessment document and is included in detailed designs.

## **6.2. ENVIRONMENTAL IMPACT MITIGATION MEASURES**

Adverse impacts on the environment and human health while implementing construction works for improvement of water supply and wastewater systems of project settlements are possible during the construction of: (i) trenches for water lines, (ii) sewage collectors and networks; (iii) pits for regulating and water metering nodes and inspection chambers, (iv) construction/reconstruction of DRRs, pump stations and chlorination stations.

To prevent air pollution with dust generated during the construction work in the settlements, the construction site and roads must be regularly watered, especially in dry weather. Dry, dusty materials are to be transported by trucks with covered carriages. Exclude burning of household garbage in the construction site.

To prevent land and water resources pollution with household wastewaters it is necessary to precisely follow the sequence of works mentioned in the DD during the implementation of construction/reconstruction works of Goris and Kapan town's sewer collectors.

After the construction of the sewer collectors to provide direct flow of the district's wastewater to the collectors, without allowing of wastewater flow into the environment, and to provide the gravity flow of the household wastewater into the town's existing and operating sewer network.

To provide the safety of drinking water pipes in the places of possible cross sections with sewer pipes in order to exclude the mixing of drinking water with wastewater. To cover the drinking water pipes with case pipes in such segments.

The sewer manholes shall be built very quickly (within 1 day), excluding the pollution of the environment, residential areas.

In Goris town, during the Vararakn river span (the design sewage line will be constructed on the external columns of the bridge) to monitor the implementation of works in the sequence mentioned in the DD to exclude wastewater flow into the river.

To exclude the pollution of Voghji river with wastewater when implementing the sewerage collector reconstruction in Kapan town by monitoring the implementation of activities as described in the DD.

During the implementation of spans over the rivers to install the water mains' supports in the places excluding the disturbance of the rivers' banks and beds.

To prevent soil erosion and sediment transport, the following is to be implemented: in inclined sites of the water line and sewer line routes implement measures for retaining the inclinations; minimize the time during which trench and pit excavations for regulation and metering nodes, inspection chambers are open.

- After completion of the construction works, clear all construction sites from the construction waste and bring them to the original shape.
- Recover the asphalt – concrete pavement, providing its previous good condition and quality.
- Provide graveling with compaction on the streets with damaged and half-destroyed asphalt-concrete pavement, as well as on earth roads.

To prevent the topsoil layer damage, or landscape degradation, the topsoil should be stored on the assigned site, thereafter used for the areas restoration when implementing the construction of water lines passing through filed roads. The construction site should be cleaned from the household and construction waste providing the previous state of landscape.

To reduce the negative impact on arable lands and grassland, it is planned to carry out construction works in autumn after harvesting. In the course of construction works, the access of vehicles to these areas is to be restricted to the extent possible. Restore damaged areas after construction.

To exclude land and water resources pollution with fuels and lubricants, the latter must be stored on a sealed surface, away from water resources; plan use of special tanks for their collection, which will then be removed to special sites envisaged for re-treatment.

To prevent environment pollution with construction and household waste, remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.

To exclude land and water resources pollution with chlorine, organize works for washing the water supply distribution network with chlorine, according to calculations. Provide appropriate technical means; implement chlorine discharge to surface water body or land area after washing the pipes, according to the planned regime.

Maximum permissible chlorine rates should be observed prior to implementing the chlorine wastewater outflow and transmission from the pits adjacent the chlorination stations into the water body or land area.

Water quality change – The Environmental monitoring plan must include also control over water quality and residual chlorine level.

Veolia Djur will implement planned sampling of supplied water, checking the quality of the water of the water sources, according to all the parameters required by the Ministry of Health. Water quality monitoring is carried out also by State Hygienic and Epidemiological Surveillance Inspectorate, according to "Drinking Water. Requirements to the Centralized Water Supply System's Water Quality"; Quality Control № 2-III-A'2-1 sanitary rules and norms" (registered on 28.12.2002), document, which establishes the requirements to the drinking water quality, as well as the rules for quality control of water produced and supplied to residential area through water supply systems.

Since drinking water is chlorinated, it is also important to monitor the residual chlorine in drinking water.

To prevent noise, night work in residential areas is to be limited, and usage of machines/equipment with extra noise is to be avoided; installation of silencers if needed.

To reduce disturbance to population because of overloaded roads safe area for trucks is to be provided; waste on the construction site must not be accumulated and burnt, construction should be implemented in stages, adequate notice of construction activities must be given to the population, effective road signs, diversions or barricades are to be provided.

To prevent hazards for workers and the population during the construction, the following must be implemented: install fencing around construction site; control access of unauthorized persons to site; place warning signs in dangerous places; carry out regular examination of equipment by highly qualified staff, as well as make regular safety audits; provide first aid and safety training to construction staff.

Provide meeting the occupational health and safety rules according to the 3 B document.

Provide community participation in the project works, which will minimize disruption to community social activities.

### 6.3. INSTITUTIONAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT

The organizational obligations for the proposed mitigating measures are distributed among the following agencies:

❖ ***Executive agencies, which are responsible for implementation of the measure.***

1. For this special task the executive agency (SAFEGE SAS - JINJ Ltd. Consortium) must provide in the design stage obtaining of all the required agreements and permits from corresponding state and local authorities, before tendering the construction works;

- Conclusion of technical expert examination;
- Conclusion of environmental expert examination (if needed);
- Agreement of the State Agency for Protection of Historical and Cultural Monuments, if impact is envisaged by the design.

2. The executive agencies in the construction stage (construction contractors) will be responsible for physical implementation of mitigating measures planned under the ESAP, as well as for obtaining of all permits and agreements required during the construction implementation. Those are:

- Construction permit from the local self-governing authorities
- Agreements from the local self-governing authorities for the sites allotted for transportation of wastes and construction garbage,
- Agreement of the State Agency for Protection of Historical and Cultural Monuments, if unexpectedly historical and cultural or archaeological monuments are discovered during the construction implementation.

3. Before commencement of the construction, the following permits and certificates must be obtained from PMU, if needed:

- Cadaster certificate on the land allotment;
- Water use permit, if needed.

❖ ***Controlling agencies, which are responsible for controlling the executive units to provide implementation of the ESAP measures by the latter***

1. Veolia Djur CJSC's PIU environmental specialists will be responsible for in time, due and reliable implementation of the works and measures in the order under the ESMP. The mentioned specialists will regularly visit the construction sites to provide due implementation of the measures aimed at mitigation of work impact. During the visits the possible gaps will be identified through the check list and the infringements in implementation of mitigating measures will be discovered.

The Veolia Djur CJSC PIU has the right also to require and check whether all permits are available and valid, all the measures and monitoring part under the ESMP are implemented



during the construction, in accordance with KfW guidelines and the RA environmental and social legislation.

2. SAFEGE SAS – JINJ LTD Consortium will also implement control of implementation of mitigating measures during the construction. The environmental specialist shall make visits to control the ESMP implementation.

**❖ *State monitoring agencies, which are responsible for observing the extent and efficiency of ESMP implementation and making corrections in the project, if needed.***

The state monitoring agencies are as follows:

- Inspectorate for Nature Protection and Mineral Resources under the Government
- Health and labor inspection body under the Government
- Service for the protection of historical environment and cultural museum reservations NCSO, as necessary
- RA local self-governance bodies,
- RA Ministry of Transport, Communication and Information Technologies.

The amounts envisaged for implementation of environmental measures included in the ESMP are included in the detailed design.

Implementation of mitigating measures for environmental impacts will be controlled regularly through visits to the construction sites. With the help of the specially developed check list the gaps and drawbacks will be discovered.

In case of not implementing or infringing the implementation of the mitigating measures, after warning, the Contract provision envisaged for this case will come into force.

#### **6.4. ENVIRONMENTAL AND SOCIAL ACTION PLAN (ESAP)**

The Environmental and Social Action Plan (ESAP) will be based on the results of IEE prepared by subproject and will include appropriate mitigation measures.

ESAP consists of two components:

1. Mitigation measures and institutional responsibilities for implementation;
2. Environmental monitoring.

The Contractor should strictly follow the environmental mitigation measures prescribed in the ESAP. The costs foreseen for the implementations of all the measures prescribed in the ESAP are included in the total cost of the Contract.

Notice on the failure to implement measures prescribed by the Technical Supervision Company (TSC) or the Client would be sent to the Contractor in written. After the Notice to Correct, the next recorded violation would trigger the damage compensation mechanism, which will be included in the Contract signed with the Contractor

The environmental management matrix is presented in Table 2.

## 6.5. ANALYSIS OF ALTERNATIVES

Alternatives of the works to be implemented under the project package were discussed, and as a result of the discussions during the preliminary design development and those with the Client, community leaders and the population, as well as based on the economic and technical calculations the works planned under the detailed design for the rehabilitation of water systems were selected.

The routes and places of structures for the newly designed W&W systems were selected by-passing protected nature conservation areas and important landscapes, as well as privatized areas, aimed at minimizing the environmental and social impacts of the project; the shortest possible routes were selected to avoid increasing of the cost of construction.

As an alternative option, only the “zero” or “no project” version is considered, in case of which no work is done in the above-mentioned communities.

As a result of leaving the water supply and wastewater systems of the project settlements in the same condition, we have huge losses of water resources, water metering system will not be in place in the villages, qualitative and quantitative requirements for drinking water are not met, the rivers and the environment are polluted with household wastewaters, residents will have health and social problems.

The household wastewater of the Goris and Kapan town is discharged to open land areas, polluting the environment, degrading land resources, creating an anti-sanitary situation in the communities and beyond their boundaries, or flows into the river in different parts of towns, contaminating the water resources, worsening irrigation water quality and breaking the ecological balance of the river.

**Table 2. Environmental and Social Action and Monitoring plan**

<b>Works and possible impacts</b>	<b>Proposed mitigating measures</b>	<b>Monitoring</b>	<b>Responsible bodies</b>
<b>Construction</b>			
1. <i>Air pollution in the settlements</i>	<ul style="list-style-type: none"> <li>- Install fencing around the construction site.</li> <li>- Regularly water the construction site and roads,</li> <li>- Provide body cover for trucks.</li> <li>- Do not accumulate and burn waste on the construction site.</li> </ul>	Daily site inspection	Contractor, Consultant, PIU
2. <i>Pollution of land and rivers with household wastewater in Goris and Kapan towns</i>	<ul style="list-style-type: none"> <li>- Construct the inspection chambers within shortest possible term.</li> <li>- Pump the wastewater into the newly built collector through submersible pumps during implementation of connections of the reconstructed/ newly constructed collectors.</li> <li>- Exclude wastewater flow to the environment, land and water resources.</li> <li>- To follow the sequence of work activities mentioned in the DD when constructing or reconstructing the collectors</li> </ul>	Daily site inspection	Contractor, Consultant, PIU
3. Soil erosion and sediment transport at slope areas of water mains and sewer lines installation	<ul style="list-style-type: none"> <li>- In inclined sites of the water and sewerage line routes implement measures for retaining the slope.</li> <li>- Minimize the time during which trench and pit excavations for water and sewerage lines, regulation and metering nodes are open.</li> <li>- Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU
4. Topsoil layer or landscape degradation in pastures	<ul style="list-style-type: none"> <li>- Remove and store the topsoil on the assigned site, at 300-500m from the construction site.</li> <li>- Cleaned the construction site from the household and construction waste.</li> <li>- Provide the previous state of landscape.</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU
5. <i>Land and water resources (rivers flowing)</i>	<ul style="list-style-type: none"> <li>- Store oil, fuels and lubricants on a sealed surface, away from water resources.</li> </ul>	Daily inspection of construction site	Contractor, Consultant, PIU

<b>Works and possible impacts</b>	<b>Proposed mitigating measures</b>	<b>Monitoring</b>	<b>Responsible bodies</b>
<i>through settlements) pollution with fuels and lubricants</i>	<ul style="list-style-type: none"> <li>- Allot isolated areas for the repair and charging of machinery, equipment with lubricants.</li> <li>- Plan specially designed storage tanks for the used lubricants, which will be subsequently removed to specific locations or to special sites for recycling.</li> </ul>		
6. <i>Environment pollution with construction and household waste</i>	<ul style="list-style-type: none"> <li>- Remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.</li> <li>- Install waste collection tanks in the construction sites and collect and remove them daily from the construction site.</li> <li>- Exclude the burning of household waste in the site.</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
7. <i>Land and water resources pollution with chlorine</i>	<ul style="list-style-type: none"> <li>- Implement disinfection of water mains and distribution network with chlorine, according to technical calculations.</li> <li>- Provide appropriate technical means for removal of chlorine water from washing.</li> <li>- Implement chlorine discharge to surface water body or land area after washing the pipes, according to the established order and the background value of the given water body.</li> <li>- Before removing the chlorine-containing wastewater stored in the chambers near the chlorination stations during operation to the water body or land area, ensure that the permissible limit amounts are met and implement the discharge according to the prescribed regime.</li> </ul>	During washing of pipelines	Contractor, Environmental inspectorate, Consultant, PIU
8. <i>Noise</i>	<ul style="list-style-type: none"> <li>- Limit night work in residential areas,</li> <li>- Avoid usage of machines/equipment with extra noise.</li> <li>- Install silencers if needed.</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
9. <i>Troubles and Dangers to Population:</i>	<ul style="list-style-type: none"> <li>- Implement the construction in phases, inform the population about the works.</li> <li>- Install appropriate traffic signs, barriers.</li> <li>- Organize by-passes.</li> <li>- Mark the construction areas (trenches) with safety ribbons,</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

Works and possible impacts	Proposed mitigating measures	Monitoring	Responsible bodies
	<ul style="list-style-type: none"> <li>- Ensure participation of the population in the implementation of the project, which will minimize the disruption of the social activity.</li> </ul>		
10. Hazards for Workers	<ul style="list-style-type: none"> <li>- Install fencing around construction site.</li> <li>- Control access of unauthorized persons to the site.</li> <li>- Place warning signs in dangerous places</li> <li>- Carry out regular examination of equipment by highly qualified staff,</li> <li>- Make regular safety audits of equipment.</li> <li>- Provide first aid and safety training to construction staff.</li> <li>- Provide workers with means necessary for work (overall, shoes, caps, earplugs, respirator masks, etc.)</li> </ul>	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

APPENDIX 1

**Դաշտային այցերի ստուգաթերթիկ**  
**Field visits checklist**

<b>Ընդհանուր տեղեկատվություն</b> <b>General information</b>	Ամիս/ամսաթիվ D/M/Y			
	Ենթաձրագիր / Subproject			
	Տեղակայում / Location			
	Շինարարական կազմակերպություն/ Constriction contractor			
	Մարզ / Marz			
<b>Նախագծում</b> <b>Design</b>				
<b>Անհրաժեշտություններ</b> <b>Required permissions</b>	Բնապահպանական փորձաքննության եզրակացություն / EEC	Այո Yes	Ոչ No	Ո/Կ N/A
	Հողհատկացման գրավոր համաձայնություն / written consent on land acquisition	Այո Yes	Ոչ No	Ո/Կ N/A
	Պատմամշակութային փորձաքննություն / assessment of impact on cultural heritage	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Շինարարություն</b> <b>Construction</b>				
<b>Անհրաժեշտ թույլ-տվություններ</b> <b>Required permissions</b>	Շին.թափոնների տեղադրման գրավոր համաձայնություն / written consent on disposal of construction waste	Այո Yes	Ոչ No	Ո/Կ N/A
	Անսպասելիորեն հայտնաբերման դեպքում պատմամշակ. համաձայնություն / written consent in case of sudden discovery of cultural heritage	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Հասարակության իրազեկում</b> <b>Public awereness</b>				
	Շին.աշխատանքների վերաբերյալ բնակչության համապատասխան իրազեկում համաձայն նախագծի / awareness of population regarding construction works according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
	Համայնքի մասնակցություն շինարարական աշխատանքներին համաձայն նախագծի / community's participation in construction works according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Անվտանգություն</b> <b>Safety</b>				
<b>Բանվորների անվտանգություն</b> <b>Safety of workers</b>	Բանվորների անվտանգության հանդերձանքի առկայություն /ականջակալներ, շնչադիմակ/ availability of safety uniforms (earflaps,mask)	Այո Yes	Ոչ No	Ո/Կ N/A

	Շինարարության մեջ ներառված տեխնիկական միջոցների պարբերական զննումներ՝ անվտանգությունն ապահովելու նպատակով / regular study of equipment used for construction for safety matter	Այո Yes	Ոչ No	Ո/Կ N/A
<b>Բնակչության անվտանգություն Safety of population</b>	Երթևեկության սահմանափակման կամ խախտման ժամանակ համապատասխան ճանապարհային նշանների կամ պատնեշների տեղադրում, շրջանցի կազմակերպում / Installation of road signs or fences, organization of a bypass during interrupted or limited traffic	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շինարարության իրականացման ժամանակ կառավարման միջոցառումներ</u></b> <b><u>Management measures during construction</u></b>				
<b>Շին.հրապարակի/ տեղանքի շահագործում / Operation on area/construction site</b>	Շին.հրապարակի/տեղանքի պարբերաբար ջրում / regular sprinkling to area/construction site	Այո Yes	Ոչ No	Ո/Կ N/A
	Մեքենաների համար ապահով տարածքի առկայություն շին.հրապարակում / availability of safe place at the construction site for vehicles	Այո Yes	Ոչ No	Ո/Կ N/A
	Յուղերի և քսուկների համապատասխան պահեստների առկայություն շին.հրապարակում / availability of storage for oils and lubricants at the appropriate part of the construction site	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Օդի ժամանակավոր աղտոտում</u></b> <b><u>Temporary air pollution/dust</u></b>				
	Շինանյութ տեղափոխող բեռնատարների վրա ծածկի օգտագործում / use of cover for the vehicle transporting construction waste	Այո Yes	Ոչ No	Ո/Կ N/A
	Շինարարության տարածքի խոնավեցում ջրի շիթով / moisturing of the construction site by water	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Հողի էրոզիա</u></b> <b><u>Soil erosion</u></b>				
	Ջատիվար տեղերում հողի էրոզիայի կանխարգելման միջոցառումների իրականացում ըստ նախագծի / soil erosion prevention measures at the slope places according to the project design	Այո Yes	Ոչ No	Ո/Կ N/A
	Փոստրակների ժամանակին հետլիցք / timely coverage of holes by soil	Այո Yes	Ոչ No	Ո/Կ N/A
	Շին.աշխատանքների ավարտից հետո վնասված մակերեսների վերանորոգում ըստ նախագծի / repair of damaged surface after completion of construction works	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Ջրի աղտոտում</u></b> <b><u>Water pollution</u></b>				
	Ջրի աղտոտում քսանյութերով և վառելանյութերով / water pollution caused by fuel and lubricants	Այո Yes	Ոչ No	Ո/Կ N/A

	Խողովակների լվացումից հետո քլորի արտահոսք համապատասխան նախագծով նախատեսված ռեժիմի / Leakage of chlorine after wash up of the pipes according to the scheduled regime.	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Աղմուկ բնակավայրերի տարածքին մոտ</u></b> <b><u>Noise close to settlements</u></b>				
	Աշխատանքների իրականացում սահմանված աշխատանքային ժամերին, հակառակ դեպքում սահմանված կարգով / implementation of the works during working hours, otherwise in projected manner	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շինարարական և կենցաղային թափոնների տեղադրում</u></b> <b><u>Construction west disposal</u></b>				
	Շինարարական և կենցաղային աղբի տեղափոխում և տեղադրում համայնքի համապատասխան աղբավայրում / transportation and disposal of construction and consumer waste in appropriate community landfill	Այո Yes	Ոչ No	Ո/Կ N/A
<b><u>Շահագործում</u></b> <b><u>Operation</u></b>				
<b>Խմելու ջրի աղտոտում / Drinking water pollution</b>	Մնացորդային քլորի քանակի համապատասխանում խմելու ջրի որակի նորմերին / Correspondence of balance quantity of residual chlorine to the quality of potable water	Այո Yes	Ոչ No	Ո/Կ N/A



**APPENDIX 2**

**Record of Interagency and Consultation Meetings**

*The records of the Consultation Meetings are given in Book 3-B-II.1.*

**APPENDIX 3**

**List of EA Report Preparers**

1. Arevik Hovsepyan – JINJ LTD, Head of Environmental Department
2. Hasmik Ghalachyan – Botanist, expert.

**APPENDIX 4****References**

The RA Law "On Environmental Impact and Monitoring" (2014)

The RA Law "On Flora" (1999)

The RA Law "On Fauna" (2000)

The RA Law on "Lake Sevan" (2001)

Red Book of Plants of Armenia (2009)

Red Book of Animals of Armenia (2010)

Sustainability guidelines of KfW Bankengruppe (adopted on 2 October 2012)

Sustainability Guideline: Assessment of Environmental, Social, and Climate Performance: Principles and Process April 2016

**APPENDIX 5****LIST OF ABBREVIATIONS**

RA	Republic of Armenia
RA MoNP	RA Ministry of Nature Protection
RA MoH	RA Ministry of Healthcare
RA MoT&C	RA Ministry of Transport and Communication
RA MoC	RA Ministry of Culture
LSGB	Local Self-Governmental Bodies
KfW	German Development Bank
EIA	Environmental Impact Assessment
PIU	Project Implementation Unit
ESMP	Environmental and Social Management Plan
ESMMP	Environmental and Social Management and Monitoring Plan
IESE	Initial Environmental and Social Examination
DD	Detail Design
EAIC	Existing angular inspection chamber
AIC	Angular inspection chamber
DRR	Daily regulation reservoir
W&W system	Water supply and wastewater system
WRMA	Water Resources Management Agency
SNCO	State Non Commercial Organization