STATE COMMITTEE OF WATER ECONOMY OF THE RA MEINR
STATE AGENCY "WATER SECTOR PROJECT IMPLEMENTATION UNIT"

FINANCED BY

GOVERNMENT OF THE REPUBLIC OF ARMENIA

GERMAN DEVELOPMENT BANK (THE "KFW")

GERMAN COOPERATION

EUROPEAN INVESTMENT BANK (THE "EIB")

EU NEIGHBORHOOD INVESTMENT FACILITY (THE "NIF")

"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-A. GEGHARKUNIK MARZ

Sub-Package 3-A-I IMPROVEMENT OF W&W SYSTEMS OF GAGARIN, JRARAT, TSAGHKUNK, TSAGHKASHEN, SEMYONOVKA VILLAGES, RECONSTRUCTION OF SEVAN COLLECTOR

Book 3-A-I.3a ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

Inv. № 170104/a

Yerevan,
July, 2020

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JINJ Ltd, Director **E. Mesropyan**

Chief engineer of design **A. Davtyan**

Yerevan,
July, 2020

PACKAGE 3-A. GEGHARKUNIK MARZ IN RA

Sub-Package 3-A-I

IMPROVEMENT OF W&W SYSTEMS OF GAGARIN, JRARAT, TSAGHKUNK, TSAGHKASHEN, SEMYONOVKA VILLAGES, RECONSTRUCTION OF SEVAN COLLECTOR

COVER OF THE DETAILED DESIGN

Book 3-A-I.1 - GENERAL PROVISIONS

Book 3-A-I.2 - TECHNICAL SPECIFICATIONS

Book 3-A-I.3a - ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

Book 3-A-I.3b - OCCUPATIONAL HEALTH AND SAFETY GIUDELINES

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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 State Committee of Water Economy (SCWE), the Water Sector PIU SI, 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 Gagarin settlement and Jrarat, Tsaghkunk, Tsaghkashen, Semyonovka villages, as well as reconstruction of the main sewage collector of Sevan town of the RA Gegharkunik marz.

To achieve this goal, the following is planned:

- Construction and reconstruction of headwork structures – spring intakes (Semyonovka, Tsaghkashen).
- Construction and reconstruction of DRRs and their sanitary zones (Gagarin and Jrarat, Semyonovka, Tsaghkashen).
- Construction of chlorination stations (Semyonovka, Tsaghkashen, Geghhovit).
- Construction of DN 90-225 diameter 15218.0 lm water mains (Gagarin, Jrarat, Tsaghkunk, Semyonovka, Tsaghkashen).
- Construction, reconstruction and repair of 19133.0 lm water distribution networks.
- Construction and reconstruction of regulating and water metering chambers (29 pcs.)
- Construction of fire hydrants (15 pcs.).
- Reconstruction of main sewage collector of Sevan town.
- Construction of sewage collector of Gagarin settlement (3329.0 lm).

Implementation of the water and wastewater systems improvement project will allow providing safe, reliable and sustainable water supply to the consumers of the above mentioned settlements (household (about 5000 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 later 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 Labour 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 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).

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 Water Committee 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 all of the above mentioned settlements.

The water resource management and protection function is currently being implemented by the Water Resources Management Agency (WRMA) 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, The Health and Labout Inspection Body of the Republic of Armenia has been functioning, which is a subordinate body of the Government of the Republic of Armenia exercising supervison 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 wastewater systems of Sevan town and its Gagarin district, Jrarat, Tsaghkashen, Tsaghkunk and Semyonovka villages in Gegharkunik marz, the design for which was implemented by SAFEGE SAS - JINJ LTD Consortium.

Rehabilitation of water supply and wastewater systems in rural settlements includes reconstruction and construction of spring intakes, water intake structures, DRRs, pumping stations and chlorination stations, reconstruction of water supply (water main and distribution network) and sewerage system (sewer collector) 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 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 WASTEWATER SYSTEMS OF SEVAN TOWN AND GAGRIN SETTLEMENT

The wastewater system of Sevan town (Sevan-Qaghsi main collector, about 2.7km long and internal network, about 70km long) was built in 1965-1980. The collectors of the wastewater systems Varser, Gagarin, Ddmashen, Geghamavan villages are also connected to the Sevan town's main collector. The sewerage network is made of 150-800 mm pipes of different materials. The apartment buildings (201) and about 90% of the individual houses are connected to the sewerage system.

In the past the wastewater of Sevan town was removed through the main sewerage collector to the Kaghsi WWTP, which has not been operating since the 1990s and it is completely deteriorated at the moment.

Sevan-Kaghsi main collector is in poor condition, there are many blockages and wastewater directly flows into the Hrazdan River from the mid-part of the collector. Besides, at the end of the village of Geghhovit, at the canal, the collector passes over the canal and pours into destroyed concrete puddle, creating an anti-sanitary and epidemic situation around it.

The town's sewerage network is also in a poor condition, most of the manholes are damaged and cause often blockages. In recent years, some segments of collectors of several districts were reconstructed under the former AWSC's funds.
Some of the pumping stations are not currently operated, as a result of the repair works and the changed lines in the wastewater network in recent years. Only two pumping stations conditionally named №3 and №5 are operated presently. The buildings of the pumping stations are in technically good condition.
The buildings are protected by the general safety and fire regulations; they are equipped with a ventilation system. Valves are installed on the discharge pipes of the pumps, and flow meters are installed on the common collectors. The pumps are controlled by an automatic control panel, which makes the operation easy.
The sanitary protection zones of the pumping stations are fenced and in fair condition; the buildings are improved in general.
Sevan has also a storm sewer system, which operates independently of the sewerage system.

The majority of academic, administrative and apartment buildings of Gagarin settlements are connected to the sewerage system, with a total length of about 6.0 km**.** The wastewater network is implemented of 150-300mm pipes made of different materials, which are in poor condition. The general emergency situation in the wastewater system (emergency manholes, emergency collectors and outlets) and the resulting leaks cause serious social and health problems. The basement floors of the buildings are filled with wastewater, resulting shrinkage of the buildings' foundations. It is an anti-sanitary condition in the settlement.

The 2.7 km long 250 mm polyethylene corrugated collector removing the household wastewater of the community was reconstructed in recent years and is in a satisfactory condition.

4.2. DESCRIPTION OF WATER SUPPLY SYSTEMS OF GAGARIN, JRARAT, TSAGHKASHEN, TSAGHKUNK AND SEMYONOVKA VILLAGES

Water supply to Gagarin settlement is carried out from Lchashen-Sevan system, from the distribution node of the mentioned system, through the 4.7 km long polyethylene water main starting from the distribution node of Lchashen-Sevan water main.
Water is supplied to the settlement directly from the water main, which has been rebuilt in recent years, since Gagarin's existing DRR is in an emergency condition and does not operate, nor does it have a dominant position over the entire area of the settlement.
Disinfection in the Lchashen-Sevan system is implemented in Lchashen chlorination station.
Gagarin's water distribution network was put into operation in the 1960s and in general is in poor condition. The total length of the network is about 4.3 km; it is mainly made of 100-250mm steel and cast iron pipes. About 200m long pipes in the apartment buildings part of the distribution network have been replaced in recent years.
There are also problems with pressure in the distribution network, which are mainly expressed in the sectors of high-rise buildings. In the past, water supply to high-rise buildings was carried out through a pumping station built adjacent to the buildings, which currently does not operate and is in poor condition.

Water supply to Jrarat village is carried out from the north-western sector of the Lchashen-Sevan system. The total length of the water main from Gagarin village to the inlet pipe of Jrarat village is about 3.5 km, made of 300 mm diameter steel pipes and is in satisfactory condition. At present water supply to the village is implemented directly from this water main, with 3km long steel inlet line, since the DRRs constructed in Soviet times are in emergency condition, and it is not advisable to operate them, especially during the winter time, due to lack of access-roads.
Jrarat village's distribution network was put into operation in the 1970s. It is mainly made of 32-150mm steel pipes. The total length the network is about 2.5 km, which is almost entirely in an emergency situation. Leakage level is considerable in the network.
Water metering is not implemented in the distribution network of the village.

Water supply to Tsaghkashen village is carried out from captured springs "Balak" located in the north-western part of the village, at 2540 mm altitude. There are four spring intakes in the spring area. The spring intakes and the water intake were built in the 1960s; they are in a completely dilapidated state. The sanitary protection zone of water springs is missing.
Water is supplied from the springs through about 4.3 km long water main (built in 1967) to the DRR existing in the village. About 1.0 km of the main is made of asbestos cement pipes. The water main is completely deteriorated, and the DRR needs repair.
Water metering is not implemented in the system.
Regular disinfection is not implemented in the system.
Water **supply distribution network** of the village (about 2.5 km) was built in 2002, made of 50-100mm steel pipes. In 2012 some parts (1.1 km) were replaced with polyethylene pipes. The

replaced pipes have been implemented in violation of the norms; the burying depths of the pipes have not been met.
Tsaghkashen village's water supply system is currently maintained by the LSG. There is no individual water metering in the distribution network of the village, there is no disinfection in the system.

Water supply to Tsaghkunk village is implemented from the artificially supplied underflow intake located to the north-east of the village, at the absolute elevation of 1951 m, by gravity. The underflow intake was built in 2011-2012. The water main from the water intake to the DRR is in good condition. Disinfection is not implemented in the water system.
The community has a problem related to the supplied water quality, which is sharpened especially during the rainy seasons and snow melting. The reason is the non-conformity of the sizes of the filtering load and the amount of water entering the system to the design requirements, as well as the absence of protective upper layers. The cause of turbidity can also be the fact that the topsoil on the right and left banks of the river was washed out due to construction work.
The **water supply distribution network** of the village (about 6.5 km) was put into operation in the 1970s; It is mainly made of 50 mm -150 mm steel pipes. The distribution network is in almost completely damaged condition, there are leaks, and therefore, it is impossible to provide water supply to higher located districts, without terminating the supply to the low-lying districts. The valve chambers are also in a poor condition. The water is supplied once in three days by district.
Individual water metering is not implemented in the distribution network. The system is serviced by the LSG.

Water supply to Semyonovka village is carried out from captured springs located at 2240 m absolute elevation, by gravity. The spring water is supplied to the village through about 3.0 km long polyethylene water main. The pipe of the underflow water intake constructed on the route of the water main also joins the mentioned water main. Nearby the village the water main branches into two pipelines, supplying the distribution network.
At 2161 m absolute elevation there is a 300m^3 capacity DRR in the village, which is in emergency situation and does not operate.
The village does not have a regular water supply distribution network. The water main from the springs branches into two separate water lines (about 2.0km) in the distribution chamber near the village, providing water supply to the village' two streets. There is a monument-spring in the village, from which some residents have built water lines on their own, while others carry water in buckets.
Individual water metering is not implemented in the distribution network. The system is serviced by the LSG.

4.3. DESCRIPTION OF THE PROPOSED REHABILITATION WORKS

For rehabilitation of *Sevan town's* wastewater system it is planned to reconstruct/replace two segments of the existing sewage collector, 2.3km total length and the inspection chambers; the

second segment of the reconstructed collector reaches the newly constructed WWTP area (near the bridge in Tsaghkunk village).
First, 629.0 lm long segment of the collector will be replaced (from EAIC-1 to EAIC-17, see the WWTP drawing part, sheet-VI-2), implementing it with DN500 (GF) mm polyethylene corrugated socket pipes and reconstruct the two inspection chambers.
The beginning part of the collector, L=106.0m long (EAIC-1 to AIC-7) is planned to be implemented underground. Then, from the inspection chamber AIC-7 to the inspection chamber AIC-13, it is planned to lay over ground, left and parallel to the existing main collector. Afterwards, from AIC-14 to EAIC-17, the 160m long segment is again to be laid underground.

The over ground part of this segment of the collector passes through the residential area of the village of Varser.
As a result, from the EAIC-1 chamber the household wastewater will be removed by gravity to the EAIC-17 inspection chamber.
The route of the constructed collector passes parallel to the route of the existing collector, and the works will be carried out in the alienation zone of the sewage collector, without damaging the adjacent areas.

The next reconstructed segment of the existing collector, 1648,0 m (SC_2, see the drawing part sheet WW-VI-8, 9) lies from the end of Geghhovit village to the WWTP designed in the area of Tsaghkunk village.

The DD plans construction of a back-drop chamber on the right side of the canal at the end of the village of Geghhovit, which will receive the wastewater from the main steel collector passing over the canal span. Then, a 500mm, L=1648.0m long polyethylene corrugated socket sewage collector will be laid underground, on the right of the existing collector, which will allow to transport the household wastewater by gravity to the designed WWTP (EIC-29 MP16+48).
The existing sewage collector passes through the administrative area of Geghhovit village. The designed sewage collector will pass parallel to the existing one through the alienation zone.

It is planned also to connect Gagarin's 300mm polyethylene corrugated socket main sewage collector to the designed SC_2 collector's inspection chamber NIC-8 (MP 3+98).

It is planned to construct/reconstruct inspection chambers throughout the length of the collector, according to the existing norms (SNIP).
Besides, reconstruction of the inspection chamber of the main collector is planned, as well as concreting of the opened seams of the concrete pipeline.
For rehabilitation of *Gagarin settlement's* wastewater system the following is planned: reconstruction / construction of collectors (C_1, C_2, C_3) in different parts of the community, construction of different types of inspection chambers on them, construction of a pumping station, which will allow pumping of the community wastewater to the main sewage collector. It is also planned to dismantle septic tanks adjacent to multi-apartment buildings.
The pumping station is planned to be built in the place of the last outlet inspection chamber of the sewage collector (community-owned land).

To rehabilitate *Gagarin community's* water supply system, it is envisaged to build a 500m^3 over ground DRR at 1924m absolute elevation, in an area belonging to Geghamavan community not far from Gagarin, which will satisfy the Gagarin and Jrarat communities' water demand. The DRR is intended to be built in the administrative area of Geghamavan village on the community-owned land (there is no land alienation problem).

To provide water supply to the DRR it is planned to build a 232.0 m long, 160 mm polyethylene pipeline, as well as a 558.0 m long 225mm and 232.0 m long, 160 mm polyethylene water pipelines, for providing water supply to the distribution networks of Gagarin and Jrarat villages respectively. These three pipelines are planned to be implemented in the same trench, maintaining the required distances.

The water mains' trench runs through the community-owned land, where there are no arable lands and other usable areas (no problem of compensation to population) .

For metering the amount of water supplied to Gagarin and Jrarat communities, it is envisaged to build a water metering chamber in the area of the DRR, with electromagnetic flow meters and to build a sanitary zone.

For improvement of internal water supply network of Gagarin it is planned construction of about 3.9 km long DN32-DN225 (HDPE) polyethylene water lines, construction of new inlet lines for 85 private houses (1110.0 m long DN20-DN40 (HDPE) polyethylene pipes). It is planned also to construct new inlet lines for 16 public buildings of the settlement (160.0m besides, it is planned to replace the inlet lines (about 600m) of three 5-storey and twenty one 2-storey apartment buildings

In different parts of the distribution network underground fire hydrant chambers are planned to be constructed.

To rehabilitate *Jrarat village's* water supply system, it is planned to construct a 232.0m long 160mm polyethylene water line from Gagarin DRR to the inlet line of the village, as well as to replace the last 3260.0m segment of the water main supplying the distribution network.
The water main passes through the administrative area of Hrazdan town. The water main route passes through the earth road, on both sides of which are arable lands.

Installing individual water meters is also planned for supplying Sevan's penitentiary and the gas station, as well as construction of a new about 50m long polyethylene pipeline to connect to the existing line of each of these facilities. Besides, construction of outlet, air vent, and pressure reducing chambers and sanitary zone metal fence is planned.

In addition, it is planned to construct a 1.5 km long water supply internal network, inlet lines (1808.0m) of 135 private houses, 8 public and 8 production facilities, and to install water metering and regulation chambers and underground fire hydrants chambers.

For rehabilitation of *Tsaghkashen village's* water supply system, the DD plans reconstruction of water springs, DRR and 4.4 km water mains.

The route of the water main passes through mid field road at the two sides of which there are arable lands and grasslands.
In order to improve the internal water supply network in Tsaghkashen village, construction of 4.23 km long polyethylene water lines, new 1955.0m long polyethylene inlet lines of 120 private houses with water metering nodes is planned. In addition, construction of new polyethylene inlet lines with 30.0m length for 3 public facilities of the settlement and installation of water metering r/c chambers is also planned.
In different parts of the distribution network regulation chambers and underground fire hydrant chambers are planned to be constructed.

For rehabilitation of *Tsaghkunk village's* water supply system, construction of about 5.2km long new water main, dyking of the open area of the DRR, replacement of the water supply chamber's cover plate is planned.

It is envisaged to construct a water metering chamber on the pipe supplying the reservoir and install a water meter.
A segment of the net of metal fence of the DRR and the sanitary protection zone of the chlorination station will also be restored and a three-row barbed wire will be laid on the fence.

For reconstruction of internal **water supply network**, construction of 7.1 km long polyethylene water lines is planned, as well as construction of new 3815.0m long polyethylene inlet lines of private houses. In addition, construction of new polyethylene inlet lines with 30.0m length for 3 public facilities of the settlement, including the water metering node is also planned.

In different parts of the distribution network valve chambers and underground fire hydrant chambers are planned to be constructed.

To improve the water supply system of *Semyonovka village*, it is envisaged to reconstruct 1 spring intake of classic type, non-return filter and 1 upward type water intake, with an appropriate filtration layer and a drainage pipe.

It is planned to construct new water mains from the spring intake to the water intake connector joint (water main W MP7+70; about 770.0 m in length) and about 853 m segment of the end part of the water main from the water intake structures to the DRR (water main W MP30 + 93-39 + 46). It is also planned to build pressure reducing, outlet, air vent and valve chambers.

It is envisaged to construct a half-buried, 1x50 m^3 DRR in the upper part of the village Semyonovka, at an absolute height of 2070 m. The DRR is planned to be built in the administrative area of Semyonovka; an agreement was reached with the village mayor for construction. It is intended to build two water lines from the DRR that will supply the distribution network of the village.

In the area of the DRR it is envisaged to construct an electromagnetic flow meter, a chlorination station to disinfect the water supplied to the village and to fence the sanitary zone with metal fence.

It is planned to build another 100m^3 capacity DRR in this DRR area in the future. This fact has also been taken into account for land acquisition and designing of metal fence for the sanitary protection zone.

Construction of 2,443 km of polyethylene water lines for the reconstruction of the village distribution network is planned. Construction of new inlet lines for 70 individual houses and 4 public buildings (1092.0 m and 10.0 m, respectively), construction of water metering, regulating valve node and underground fire hydrant chambers.

Table 1 Brief description of the planned works

Works	M/U	Settlement																		
		Sevan town			Gagarin			Jrarat			Tsaghkunk			Tsaghkashen			Semyonovka		
		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
Reconstruction / construction of water springs	piece														1			2	
Construction / reconstruction of external water supply network, their washing and disinfecting	km					0.464			3.540			5.186			4.405			1.623	
							0.464	0.085	1.155	2.300		5.186 Along the asphalt road side				4.405			1.623
Construction / reconstruction of internal water supply network, their washing and disinfecting	km					3.900			1.460			7.100			4.230			2.443	
					0.812	2.856	0.232		1.460		1.427	5.673		0.831	3.399		0.977	1.466	
Reconstruction / construction of DRRs	piece					1						1			1			1	
						Community lands						Community lands			Community lands			Community lands	
Construction / reconstruction of water supply and sewage pumping stations	piece					1													
Construction / reconstruction of chlorination stations	piece														1			1	
Construction of inlet lines of private houses	km					1.270			1.808			3.815			1.985			1.092	
					0.150	1.120			1.808		0.360	3.455		0.084	1.901		0.276	0.816	
Connection of water metering nodes of private houses	set					101			143			226			123			70	
Construction of inlet lines of apartment buildings	km					0.610													
					0.168	0.442													
Construction of water supply and water metering chambers	set					1			7			10			5			6	
Construction / reconstruction of sewage collector	km	2.277													2.1			4.0	
				2.777															
Construction / reconstruction of internal sewerage network	km					1.065									2.1			4.0	
					0.155	0.910													
Construction / reconstruction of inspection chambers	set	86				35													

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 at the distance mentioned in the document issued by each community head.

5. BASELINE ENVIRONMENTAL CONDITIONS

5.1. GEOGRAPHIC LOCATION AND CLIMATE OF THE SETTLEMENTS

The project settlements are located in Gegharkunik region of Armenia, in the northern, western, northwestern parts of Lake Sevan, at about 60-100 km from Yerevan (Gagarin, Tsaghkashen). These settlements are located in the areas adjacent to Semyonovka-Sevan-Gagarin and Sevan-Gavar highways and at 1910-2160m elevations.

The climate is conditioned with the influence of Lake Sevan; it is continental, with short cool summers and cold winters.

Absolute maximum air temperature is +33°C, and the absolute minimum air temperature is -32°C. Annual precipitation is 588mm. Western and north-western winds with 3.2m/s velocity predominate here. During 20 years, winds of 27m/sec velocity are possible. Snow cover thickness reaches 163 cm.

Maximum land freezing depth is 114cm.

Climate change effects are related to Lake Sevan. According to information provided in the National Climate Change Reports, Armenia's water resources and, in particular, Lake Sevan are vulnerable to the effects of climate change, which is the result of the increase in temperature and the evaporation from the lake surface and the reduction of the flow of rivers flowing into the lake.

The number of population of Sevan, Gagarin and Jrarat, Tsaghkunk, Semyonovka and Tsaghkashen villages according to the RA National Statistical Service web site as of 01.01.2016 is 29264.

5.2. GEOLOGY OF THE STUDIED AREA

Sevan syncline represents a Neogen-Antropogene tectonic depression, composed of lacustrine-fluvial sediments of Upper Pliocene. However, the formation of Lake Sevan was also related to the braking of lavas erupted from Geghama mountain shield (in Varser village area).

Sevan town, Gagarin settlement and adjacent village Jrarat are located on the left bank of the Hrazdan river and Tsaghkunk village is located on the right bank of the river. Semyonovka village is located north of the town of Sevan, in the northern part of Lake Sevan. These settlements are mainly located in the region of volcanic plateau, eroded-weathered slopes, lacustrine-sedimentary, river valley. Tsaghkashen village is located in the south-west of the town of Gavar in Gavar region. These settlements are located in the region of the volcanic plateau of Geghama and Vardenis mountains, eroded-weathered slopes, lacustrine-sedimentary (former lake), and fluvial-sedimentary (Gavaraget, Argichi, Martuni, Masrik rivers), hill zones.
From orographic point of view the area is located in the zone of Geghama mountain ridge.
The geological structure of the area is represented by volcanic and volcanic-sedimentary rocks, such as porphyrite, tuff breccia etc. volcanic formations of Pliocene Miocene age. The layers are

covered with Quaternary alluvial origin formations - clay, sand and coarse clastic rocks; their thickness exceeds 18.0 m in some cases.

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

- Water bearing complex of deluvial-proluvial sediments;
- Complex of Quaternary lava sediments;
- Complex of metamorphic and volcanic-crushed rocks.

Among dangerous physical-geological phenomena are stone falls, stone slides, flooding in riparian zone, side and bed erosion in beds. Intense shore deterioration processes take place along the whole length of Lake Sevan shore. Silty rocks are corrosive to the concrete media. The main soil types common in the region are: mountain brown, mountain black soils, mountain-forest, and brown soils.

5.3. BIODIVERSITY

The area is notable for its unique and rich biodiversity, geological and landscape complexes and their separate components. Sevan basin geographical position, unique climate and variety of flora have created a suitable environment for fauna.

Flora

The area is located in Sevan floristic region. It includes unique and endangered and endemic species of Armenian flora. In Lake Sevan basin there are 23 plant species endemic to Armenia, 13 of which are endemic to Sevan floristic region.

The vegetation in Sevan basin has a pronounced mosaic nature; here also the zoning is very well expressed.

Sevan's south and south-west coasts - Tsaghkashen village area is represented by mountainous steppe symbioses: here Festuca valesiaca, Koeleria cristata, Stipa tripsa and other species are dominant. Tragacanth astragalus and thyme also occur here. With the height the mountain steppes are replaced with mountainous valley-steppes, where Festuca valesiaca, Festuca ovina, Carex hurmilis, Poa pratensis, etc. occur.

In Areguni mountain slopes and in the northern part of the Lake (Sevan town, Gagarin settlement, and Jrarat, Tsaghkunk and Semyonovka villages) the lower zone is comprised of tragacanth astragalus bushes, Astragalus aureus A. Microcephalus, etc. Higher, at 2000-2100 m elevations, along with meadow-steppe plants also / Quercus macranthera residual oak forests and prairie grasses and xerophilous shrubs occur.

Vegetation of the area subject to immediate impact

The immediate area of impact includes the following parts:

- About 2.3 km segment of Kaghsi-Sevan sewage collector from Sevan town,
- About 400m segment of sewage collector that through the village of Varser and that part of the Hrazdan River,
- The last 3260.0m segment of Jrarat village’s water main.

The study of the flora of the project area was done in early spring 2017 by linear-route method. All of the above mentioned sites a\were studied, description of the plants was provided. It can be confidently stated that in all sites mainly the same species grow, with insignificant differences. It can be noted also that from floristic point of view the flora of the area is rich in species composition.

Fig.1 Anthemis cotula

Fig. 2 Cichorium intybus

Fig.3 Taraxacum officinale

During the field studies, special attention has been paid to rare and endangered plant species, as well as the species of wide application (medicinal herbs and edible plants). As a result of the studies species of plants included in the Red Book were not found in the studied area.

The flora of the impact area is mainly represented by mountainous-steppe families, with predominant Festuca valesiaca, Koeleria cristata, Stipa tripsa, etc. There are also Carex hurmilis, Poa pratensis, Cichorium intybus, Anthemis cotula, Taraxacum officinale, etc.

Bushes of Sorbus kuznetsovii, Rosa spinosissima, R. canina, Spiraea crenata, crataegus orientalis, Salix caprea also occur here.

Taking into account the fact that the studies of the impact areas have not been made throughout the growing period, the data on the plants in the Red Book of Armenia / 2010 /, literature data and the herbarium collections of the National Academy of Sciences, Institute of Botany were taken as basis.

List of plants recorded in the area of direct impact:

Alliaceae

Allium atroviolaceum Boiss.

Allium schoenoprasum L.

Amaranthaceae

Amaranthus retroflexus L.

Apiaceae

Apium graveolens L .

Chamaesciadium acaule (Bieb.) Boiss

Daucus carota L.

Falcaria vulgaris Bernh.

Heracleum pastinacifolium C.Koch

Hippomarathrum microcarpum (Bieb.) V.Petrov

Asparagaceae

Asparagus officinalis

Asteraceae

Artemisia absinthium

Centaurea polypodiifolia Boiss.

Cirsium aduncum Fisch.et C.A.Mey.ex Dc

Cousinia macrocephala C.A.Mey

Lactuca georgica Grossh

Taraxacum officinale Wigg.

Tragopogon latifolius Boiss.

Brassicaceae

Alyssum murale Waldst. et Kit.

Raphanus raphanistrum L.

Campanulaceae

Campanula stevenii Bieb.

Cyperaceae

Carex acrifolia V.Krecz.

Fabaceae

Medicago caerulea Less. ex Ledeb.

Onobrychis cornuta(L.) Desv.

Trifolium pretense L.

Lamiaceae

Thymus kotschyanus Boiss. et Hohen

Poaceae

Avena pubescens(Huds.) Pilg

Festuca ovina L.

Poa annua L.

Fauna

The fauna is divided into two big groups. The first group includes land animals. Aquatic animals are classified in the second group. From the animal category, there are the following species: mammals (34 species), birds (267 species), amphibious (3 species), reptiles (17 species) and fishes (9 species).

Forty eight species of the birds in Lake Sevan basin are nesting birds. Among them are Fulia atra, Anas platyrhynchos, Larus arg. armenicus But. Among the birds registered in the RA Red Book, the following species are recorded: Phalacrocorax carbo, Phalacrocorax pygmaeus, Egretta alba, Plegadis falcinellus, Phoenicopterus roseus, Cygnus cygnus, Tadorna tatorna, Ancas ctrepara and Himantopus himantopus.
Among reptiles there are L. unisexualis, L. nairensis, L. rostombekovi, from snakes, there are Natrix natrix, tesselata, Coronella austriaca. Among amphibious there are Bufo viridis, Rana ridibunda and Rana macrocnemus.
Among fishes there are Salmo fario, Salmo ischchan Kessler with its 4 races Curegonus laveratus, Barbus goktschaicus Kessler, Varicorhinus capoeta and Carassius car L.

Water ecosystems
During the rehabilitation of Sevan town and Gagarin settlemen's sewage system the construction work will be implemented in the area near Hrazdan river and Sevan-Hrazdan irrigation main. A back drop chamber is planned to be constructed at the right side of the canal located at the end of Geghhovit village, where the wastewater from the main steel collector passing over the canal span will be discharged.

Specially protected nature areas
The nearest specially protected area is Sevan National Park. It was founded in 1978 and is located at 1890-3597m altitude above sea level. The Park has scientific, conservation, administrative-economic and recreation departments and 4 branches. The main objectives of its activity are protection of natural ecosystems and landscapes of the area, biodiversity protection and restoration, ensuring targeted use of natural resources and cultural and historical monuments. "Sevan" national park is located at 15 km distance from the impact area.

Historic-cultural monuments
There are 10,000 small and large monuments registered in Gegharkunik region that date back to the Old Stone Age to modern times.

The project settlements, except Tsaghkunk and Lichk rural areas, do not have cultural, historical or archaeological areas. St. Sarkis Church and the Holy Resurrection Church, St. Hovhannes, Tsiranavor, Tsaghkvank chapels, Sakonts old cemetery Krjot Cross are in Tsaghkunk village.

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 Hrazdan 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 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 26800 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 works to be implemented within the project framework are mainly reconstruction works designed to be implemented in the sanitary protection zones of former water mains, sewer lines and infrastructures. The routes of the planned newly constructed water supply and wastewater systems in most cases pass parallel the reoutes of the existing systems in the alienated zone areas. 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 Gagarin (0.7 km), Jrarat (2.3 km), Tsaghkashen (4.4km), Semyonovka (3.2km) villages. 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, as well as during reconstruction of inspection chambers in Sevan town and Gagarin, environmental

pollution with household wastewater and a violation of sanitary and hygienic safety in those areas is possible.

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.

The works planned to be implemented within this package will have considerable positive impacts upon the social condition of the population. It will directly improve the life quality of the inhabitants of the communities by providing sustainable water supply and wastewater services, prudent use of water resources for about 50000 customers.
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 Sevan town, Gagarin settlement, Jrarat, Tsaghkunk, Tsaghkashen and Semyonovka 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, it is necessary to strictly follow the activities specified in the DD When constructing the 400 m segment of the Sevan-Kaghsi collector and connecting it to the existing collector, it is necessary to remove the wastewater from the last and the first manholes by means of a submersible pump and fill it in the newly constructed collector (through the hole opened in the collector, which shall be closed at the end).
To provide the safety of drinking water pipes at possible places of intersection of the sewage system pipes with those of drinking water for the purpose of excluding the mixing of drinking water with sewage water; to cover drinking water pipes with case pipes at such segments.
To provide the safety during the implementation of the span segment of Sevan sewer collector over the canal to the back drop chamber for the wastewaters not to be filled into the irrigation system.
In Gagarin settlement, during the conservation of septic pits, to empty the pits with cesspool machine, to disinfect the pits and fill with soil.
The sewer manholes shall be built very quickly (within 1 day), excluding the pollution of the environment, residential areas, lands and Hrazdan River 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; 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*, when constructing water mains passing through mid field roads; the topsoil of the near road areas should be stored on the assigned site, thereafter used for the areas restoration, as necessary. 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 exclude *irrigation water pollution with wastewaters* during the implementation of the sewer collector span over the canal in Varser village area; the span should be implemented with case pipe.

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.

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 *arable lands*, 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 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: **i**nstall 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 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.

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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 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 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 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 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” versions considered, in case of which no work is done in the above-mentioned communities.

As a result, Sevan town’s and Gagarin settlement’s household wastewater is not removed to the WWTP, but are discharged to open land areas, polluting the environment, degrading land resources, creating an anti-sanitary situation in the communities and beyond their boundaries, or flow into the Hrazdan River, contaminating the water resources, worsening irrigation water quality and breaking the ecological balance of the Hrazdan River.

As a result of leaving the water supply systems of Gagarin, Jrarat, Semyonovka, Tsaghkashen and Tsaghkunk 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

Works and possible impacts	Proposed mitigating measures	Monitoring	Responsible bodies
Construction			
1. *Air pollution in the settlements*	- Install fencing around the construction site. - Regularly water the construction site and roads. - Provide body cover for trucks. - Do not accumulate and burn waste on the construction site.	Daily site inspection	Contractor, Consultant, PIU
2. Pollution of environment with household wastewater	- Construct the inspection chambers within shortest possible term. - Pump the wastewater into the newly built collector through submersible pumps during implementation of connections of the reconstructed/ newly constructed collectors. - Exclude wastewater flow to the environment, land and water resources. - To install the wastewater collector in case pipe at the water main span point. - To exclude wastewater flow into the irrigation canal during the construction of span collector. - To empty the pits with cesspool machine, to disinfect the pits and fill with soil when conservating Gagarin settlement's septic pits. - To transfer the contents of the cesspool machine into the sewer system.	Daily site inspection	Contractor, Consultant, PIU
3. Soil erosion and sediment transport at slopy areas of water main installations	- In inclined sites of the water and sewerage line routes implement measures for retaining the slope. - Minimize the time during which trench and pit excavations for water and sewerage lines, regulation and metering nodes are open. - Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design	Daily inspection of construction site	Contractor, Consultant, PIU
4. Topsoil layer or landscape degradation in arable lands and grass lands	- Remove and store the topsoil on the assigned site, at 300-500m from the construction site. - To organize construction sites in the areas of mid field earth roads or alienation	Daily inspection of construction site	Contractor, Consultant, PIU

Works and possible impacts	Proposed mitigating measures	Monitoring	Responsible bodies
	zones. - To avoid from entering the construction machinery into the arable lands. - Cleaned the construction site from the household and construction waste. - Provide the previous state of landscape.		
5. *Land and water resources pollution with fuels and lubricants*	- Store oil, fuels and lubricants on a sealed surface, away from water resources. - Allot isolated areas for the repair and charging of machinery, equipment with lubricants. - Plan specially designed storage tanks for the used lubricants, which will be subsequently removed to specific locations or to special sites for recycling.	Daily inspection of construction site	Contractor, Consultant, PIU
6. *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. - Install waste collection tanks in the construction sites and collect and remove them daily from the construction site. - Exclude the burning of household waste in the site.	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
7. *Land and water resources pollution with chlorine*	- Implement disinfection of water mains and distribution network with chlorine, according to technical calculations. - Provide appropriate technical means for removal of chlorine water from washing. - 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. - To provide maximum allowable chlorine concentrations within the wastewater accumulated during operation in the pits constructed adjacent the chlorination stations prior to chlorine wastewater transfer into the water body or land area, and to implement the flow in accordance with the planned regime.	During washing of pipelines	Contractor, Environmental inspectorate, Consultant, PIU
8. *Noise*	- Limit night work in residential areas, - Avoid usage of machines/equipment with extra noise. - Install silencers if needed.	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
9. *Troubles and Dangers to Population:*	- Implement the construction in phases, inform the population about the works. - Install appropriate traffic signs, barriers.	Daily inspection of construction	Contractor, LGB,

Works and possible impacts	Proposed mitigating measures	Monitoring	Responsible bodies
	- Organize by-passes. - Mark the construction areas (trenches) with safety ribbons, - Ensure participation of the population in the implementation of the project, which will minimize the disruption of the social activity.	site	Consultant, PIU
10. Hazards for Workers	- Install fencing around construction site. - Control access of unauthorized persons to the site. - Place warning signs in dangerous places - Carry out regular examination of equipment by highly qualified staff, - Make regular safety audits of equipment. - Provide first aid and safety training to construction staff. - Provide workers with means necessary for work (overall, shoes, caps, earplugs, respirator masks, etc.)	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

APPENDIX 1

Դաշտային այցերի ստուգաթերթիկ
Field visits checklist

Ընդհանուր տեղե-կատվություն General information	Ամիս/ամսաթիվ D/M/Y			
	Ենթածրագիր / Subproject			
	Տեղակայում / Location			
	Շինարարական կազմակերպություն/ Constriction contractor			
	Մարզ / Marz			
Նախագծում Design				
Անհրաժեշտություլ տվություններ Required permissions	Բնապահպանական փորձաքննության եզրակացություն / EEC	**Այո Yes**	**Ոչ No**	**Ո/Կ N/A**
	Հողհատկացման գրավոր համաձայնություն / writen 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**
Շինարարություն Construction				
Անհրաժեշտ թույլ-տվություններ Required permissions	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**
Հասարակության իրազեկում Public awareness				
	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 շինարարականան շխատանքներին համաձայն նախագծի / community's participation in construction works according to the project design	**Այո Yes**	**Ոչ No**	**Ո/Կ N/A**
Անվտանգություն Safety				
Բանվորների անվտանգություն Safety of workers	Բանվորների անվտանգության հանդերձանքի առկայություն /ականջակալներ, շնչաղիմակ/ 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**
Բնակչության անվտանգություն Safety of population	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**
<u>Շինարարության իրականացման ժամանակ կառավարման միջոցառումներ</u> <u>Management measures during construction</u>				
Շին.հրապարակի/ տեղանքի շահագործում / Operation on area/construction site	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**
<u>Օդի ժամանակավոր աղտոտում</u> <u>Temporary air pollution/dust</u>				
	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**
<u>Հողի էրոզիա</u> <u>Soil erosion</u>				
	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**
	Փոսորակների 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**
<u>Ջրի աղտոտում</u> <u>Water pollution</u>				
	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**
Աղմուկ բնակավայրերի տարածքին մոտ Noise close to settlements				
	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**
Շինարարական և կենցաղային թափոնների տեղադրում Construction west disposal				
	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**
Շահագործում Operation				
Խմելու ջրի աղտոտում / Drinking water pollution	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-A-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

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
WWTP	Wastewater treatment plant
SNIP	Construction norms and rules
IESE	Initial Environmental and Social Examination
JV	Joint Venture

STATE COMMITTEE OF WATER ECONOMY OF THE RA MEINR
STATE AGENCY "WATER SECTOR PROJECT IMPLEMENTATION UNIT"

FINANCED BY

GOVERNMENT OF THE REPUBLIC OF ARMENIA

GERMAN DEVELOPMENT BANK (THE "KFW")

GERMAN COOPERATION

EUROPEAN INVESTMENT BANK (THE "EIB")

EU NEIGHBORHOOD INVESTMENT FACILITY (THE "NIF")

"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-A. GEGHARKUNIK MARZ

Sub-Package 3-A-II IMPROVEMENT OF W&W SYSTEMS OF VARDENIS TOWN AND GEGHHOVIT VILLAGE

Book 3-A-II.3a ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

Inv. № 180503/a eng .

Yerevan,
July, 2020

STATE COMMITTEE OF WATER ECONOMY OF THE RA MEINR
STATE AGENCY "WATER SECTOR PROJECT IMPLEMENTATION UNIT"

FINANCED BY

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Book 3-A-II.3a ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

JINJ Ltd, Director **E. Mesropyan**

Chief engineer of design **A. Davtyan**

Yerevan,
July, 2020

PACKAGE 3-A. GEGHARKUNIK MARZ

Sub-Package 3-A-II

IMPROVEMENT OF W&W SYSTEMS OF VARDENIS TOWN AND GEGHHOVIT VILLAGE

COVER OF THE DETAILED DESIGN

Book 3-A-II.1 - GENERAL PROVISIONS

Book 3-A-II.2 - TECHNICAL SPECIFICATIONS

Book 3-A-II.3a - ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT

Book 3-A-II.3b - OCCUPATIONAL HEALTH AND SAFETY GIUDELINES

Book 3-A-II.4 - DESIGN DRAWINGS

Book 3-A-II.5 - BILL OF QUANTITIES

Book 3-A-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 State Committee of Water Economy (SCWE), the Water Sector PIU SI, with the joint financing of the German Development bank (KfW), European Investment Bank (EIB), and EC District 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 systems of Vardenis town and Geghhovit village of the RA Gegharkunik marz.
To achieve this goal, the following is planned in Vardenis town:

- Construction of 1x130m^3 capacity contact reservoir and dry chamber in Akunk springs' area;
- Repair of stone building to serve as chlorination station located at the left side of the entrance road in Akunk springs' area;
- Repair of the spring intake's external wall and the wall and the roof connecting belt;
- Repair of one of the 2x1000m^3 capacity non operating DRRs of Shatjrek system;
- Construction of a pump station to provide water supply to the multi-apartment buildings;
- Reconstruction of DN350-250mm water line from the spring to the pump station;
- Construction of DN250-200mm water main from the 1000m^3 DRR to the multi-apartment district;
- Construction of distribution network in two multi-apartment districts;
- Replacement of inlet lines of buildings in two multi-apartment districts.

The following is planned in Geghhovit community:

- Repair and reconstruction of 4 spring intakes;
- Construction of 2 water intakes;
- Construction of a chlorination station;
- Reconstruction of 800m^3 capacity DRR;
- Complete reconstruction of the distribution network with DN 250-32 mm diameter polyethylene pipes;
- Complete replacement of the inlet lines of individual houses and public buildings, envisaging also water metering chambers.

Implementation of the water supply system improvement project will allow providing safe, reliable and sustainable water supply to the consumers (household (about 19000 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.

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 and sustainable 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 environmental and social impacts during the construction works for improvement of drinking water supply systems.

The section on the environmental screening has been developed based on 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 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 RATIFIED BY ARMENIA

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 on the UN Framework Convention on Climate Change (2017)
This Agreement will provide keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels at the expense of reducing greenhouse gas emissions. This will also significantly reduce climate change risks and impacts, as well as increase adaptability to climate change adverse impacts and contribute to climate change resistance, not 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. The project has been classified as a category B project, in accordance with KfW Guideline, Annex 1 “Illustrative list of FC measures which may have potential significant adverse environmental and social impacts” 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, i.e. the RA Law on Environmental Impact Assessment and Expertise, the Project is classified as Category C. Under the legislation, the action undertaker must submit a preliminary evaluation application to the State Authorized Body on the basis of which the Authorized Body shall give an expertise conclusion in the initial phase 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 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 all of the above mentioned settlements.
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, The Health and Labour Inspection Body of the Republic of Armenia has been functioning, which is a subordinate body of the Government of the Republic of Armenia exercising supervison 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 systems of Vardenis town and Geghhovit village in Gegharkunik marz, the design for which was implemented by SAFEGE SAS - JINJ LTD Consortium.

Rehabilitation of water supply systems of Vardenis town and Geghhovit village includes reconstruction and repair of spring intakes, construction of water intakes, water lines,

chlorination stations, pumping station and distribution network, repair of DRRs, construction of water metering and regulating chambers.

Adverse environmental and social impacts are possible during construction work, as well as in future operation and maintenance of water supply systems. 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. Since the construction works will mainly be carried out in residential areas, the community's population will be most vulnerable in the construction phase and the construction contractor's actions should be aimed at minimizing the adverse impacts on population.
In the operation stage, the adverse environmental and population 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 system improvement are expected to be mostly positive, such as uninterrupted and stable supply of drinking water, 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 system rehabilitation project is provided.

- *Design stage*

The design works on water 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 EMP 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 EMP 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 systems.

4. SCOPE OF WORKS

4.1. DESCRIPTION OF THE EXISTING WATER SUPPLY SYSTEM OF VARDENIS TOWN

Currently water supply to Vardenis town is carried out from four springs – Akunk, Akner, Surb Vardan and Shatjrek. Under this package only the system fed from Akunk springs is planned to be improved.

The Akunk springs are situated south-west from Vardenis town, in Akunk village, at 1976m absolute elevation. The system was constructed in 1960-1970. The total spring flow is about 860.0L/sec., of which about 200 – 210L/sec. is used for water supply purposes. The area of the springs is equipped with 80m long gallery catchment structure, two water intakes, irrigation and water supply pump station, regulation nodes, etc.

All of the mentioned structures are mainly in deteriorated condition.

The springs' territory is fenced.

The total spring flow is about 860.0L/sec., of which about 160 L/sec. is used for water supply purposes.

From the gallery catchment structure the water is supplied to two 3.0x3.0m, H=2.0m sized water intake structures, and from there, through one general pipe, water is directly supplied to the town's distribution network.

Two more pipes come out of the capture structure, both of them also supply water to the distribution network of the town. Thus, water is supplied to Vardenis town by gravity through three pipes of different diameters (500mm, 400mm, 250mm). All three water pipelines are in emergency condition. Besides, different segments of their routes have appeared under private buildings.

The valve nodes in the spring area are also in a poor condition.

Disinfection is not regular and is implemented using chlorine capsules and only in a part of the catchment structure from where the 500mm gravity water main comes out.

These springs supply also Akunk village for drinking-household and irrigation purposes.

The town's water distribution network was built in 1970, with a total length of water lines of about 54 km, mostly made of steel pipes of 40-500mm in diameter. In the distribution network there are also sections of cast iron, asbestos-cement pipes, as well as different parts have been replaced by polyethylene pipes in recent years.

Some water lines in the town's distribution network run through built-up areas. Over the years irregular connections were made at different parts of the distribution network. In addition, the distribution network regulation valves are also in emergency condition, which in turn makes it nearly impossible the management of the network.

The distribution network is entirely in deteriorated situation and needs reconstruction.

According to the actual data, the amount of water entering the town is about 200 l/s, however, as a result of the poor condition of and significant losses in the distribution network, it becomes

impossible to supply the population with the necessary quantities of water for drinking and household needs and to provide the required pressures in the distribution network.

All individual households, as well as apartment and public buildings are connected to the system; however full water metering is carried out in the network.

4.2. DESCRIPTION OF THE EXISTING WATER SUPPLY SYSTEM OF GEGHHOVIT VILLAGE

Geghhovit village's water supply system is serviced by the Local Self Government Body. The water supply to the village is carried out from "Yanagh" and "Mkhedzor" springs. The works planned under this package will be implemented in the systems fed from these two springs.

The "Yanagh" system has two spring groups. In the 1st group three captured springs are involved located south-west from the village at 2380m absolute elevation. The capture structures were reconstructed during recent years and are in satisfactory condition.

In the 2nd group two captured springs are involved which are located south-west from the village at 2325m absolute elevation. These spring intake structures were also repaired in recent years and are in satisfactory condition.

There is a water intake chamber next to the spring intakes where the flows from the 1st and 2nd spring intakes mix.

From the "Yantagh" system 1st group spring intakes to the above mentioned water intake the water is transferred through 200mm steel pipes of about 1.0km long. The pipeline is in satisfactory condition.

The above mentioned water intake was constructed in 1930 and is a 1.5x1.5m, H=1.5m internal size r/c structure. It is in dilapidated condition. From the water intake water is carried to the village's operating DRRs through steel water main of about 11.5km long with pipes from 300 to 200mm in diameter. The water main was constructed in 1980s and is in satisfactory condition.

The above mentioned water intake is a small r/c structure and was constructed in 1930. It is in dilapidated condition. From the water intake water is carried to the village's operating DRRs through steel 300 mm water main of about 11.5km length.

The water main was constructed in 1980s and is in satisfactory condition.

Sanitary protection zone fence is missing in both spring intakes.

There are 2 captured springs within "Mkhedzor" system. The springs are in the south-western part of the village at the absolute elevation from 2243.0 to 2254.0m. Total outflow of the springs is about 13.0L/sec. The captures were constructed in 1980s and are in dilapidated condition.

From the spring intakes the water is carried with 100mm pipes to the r/c water intake allocated within the area of the springs. The water intake chamber is also in dilapidated condition and needs repairs. The sanitary protection zone fence is missing.

From the above mentioned water intake chamber water is directly transferred to the village distribution network through 150mm in diameter water main of about 4,0km long. The water main was constructed in 1980s and is in good condition.

From "Mkhedzor" system water is also carried out to Lernahovit village, which currently is within Geghhovit village administrative area.

Water supply to Lernahovit is carried out through 100mm in diameter steel main of about 2,0km long constructed in 1980s, which is in good condition.

At 2165m absolute elevation of the village there are three DRRs of 800m^3, 400m^3 and 250m^3 capacity respectively. The DRRs were constructed in 1980s and need repair. The 800m^3 and 400m^3 capacity DRRs have a common fenced sanitary protection zone, and that with 250m^3 capacity has a separate fenced sanitary protection zone. The sanitary zone fences need partial repairs.

No regular disinfection is carried out within this water supply system. Disinfection is carried out in the spring intakes and DRRs with chlorine capsules.

The water supply distribution network of the village was built in 1982. The total length of the water lines of the distribution network is about 23.2 km; they are made of 50-225mm steel and polyethylene pipes. In recent years, about 4.35 km of water lines have been replaced in different parts of the distribution network, which are mainly made of 50 mm polyethylene pipes; however, the necessary burying depths of the pipes is provided not in all segments.

Also, there are non-pressure polyethylene socket pipes unfit for drinking water conveyance and causing frequent accidents.

The water supply distribution network of Geghhovit village, with the exception of newly replaced sections, is in emergency condition. In section of Lernahovit village the network is fully deteriorated.

No individual water metering is carried out within the distribution network.

4.3. DESCRIPTION OF THE PROPOSED REHABILITATION WORKS

The following is planned for rehabilitation of water supply system of *Vardenis town*:

- Construction of a contact reservoir and a dry chamber in Akunk springs' area;
- Reconstruct the existing stone building located at the left side of the entry road in the same area to serve as chlorination station;
- Repair of the spring intake's external wall and the wall and the roof connecting belt;
- Replacement of the entranace gate to the area and repairs of the dilapidated parts of the fence;
- Repair the 1000m^3 capacity non operating DRR of Shatjrek system and implement a 156m long metal fence for sanitary protection zone of the DRR.
- Reconstruction and construction of DN350-250mm polyethylene water lines from the spring to the pump station and DN250-200mm polyethylene water lines from the DRR to one multi-apartment district;

Within this design, the improvements in the water supply system are carried out for two multi-apartment building districts I (Banavan) and II (Kentronakan).

The water supply to the I district is planned to be implemented from the 1000m^3 capacity DRR subject to repair fed from Shatjrek system and to construct transit DN250(HDPE) and DN225(HDPE) polyethylene pipeline of 1620m total length, DN160(HDPE) to DN110(HDPE)mm polyethylene pipeline with a total length of 2012m, as well as reconstruction of polyethylene inlet lines DN90(HDPE) to DN63(HDPE)mm, and with total length of 1607m for 27 multi apartment buildings and one (1) kindergarten.

To provide water supply to the II district it is planned to construct a polyethylene transit water line of 3935m total length from Akunk spring intakes to the district, to reconstruct polyethylene inlet water lines with total length of 1074m for 18 multi-apartment buildings, and to reconstruct polyethylene inlet water lines with total length of 200m for 10 public buildings, to construct 50 pcs. of round r/c precast valve chambers and 13 pcs of monolithic underground fire hydrant chambers.

To construct a pump station to provide water supply to the upper floors of multi-apartment buildings.

The following is planned in Geghhovit village:

- Repair of "Yanagh" system's 2nd group spring intakes' water intake chamber and dry chamber,
- Reconstruction of the water intake chamber within the same area, and construction of sanitary protection zone;
- Reconstruction of the two captured springs within the "Mkhedzor" system,
- Construction of a new water intake chamber in that area and implement a sanitary protection zone;
- Construction of a chlorination station;
- Construction of a pressure reducing chamber on "Yanagh" system water main;
- Repair of the operating 800m^3 capacity DRR.
- Reconstruction of 31km long distribution network with 250-32mm polyethylene pipes.

Table 1 Brief description of the planned works

Works	M/U	Settlement					
		Vardenis town			Geghhovit village		
		Asphalt road	Earth road	Mid field earth road	Asphalt road	Earth road	Mid field earth road
Repair/ construction of spring intake	piece				4		
Construction of water intake	piece				2		
Construction / reconstruction of internal water supply network, their washing and disinfecting Reconstruction / construction of DRRs	km	12.70			31.15		
		1.50	11.20		1.35	29.80	
Construction / reconstruction of water supply pumping stations Construction / reconstruction of chlorination stations	piece	1			1		
		Community lands			Community lands		
Construction of inlet lines of private houses and public buildings	piece	1					
Connection of water metering nodes of private houses and public buildings	piece	1			1		
Construction of inlet lines of apartment buildings	km	0.20			7.98		
		0.08	0.12		0.80	7.18	
Repair/ construction of spring intake	set	10			1140		
Construction of water intake	piece	45					
Construction / reconstruction of internal water supply network, their washing and disinfecting	set	63			50		

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 at 3km of the community, according to the document issued by each community head.

5. BASELINE ENVIRONMENTAL CONDITIONS

5.1. GEOGRAPHIC LOCATION AND CLIMATE OF THE SETTLEMENTS

Vardenis town is located in Gegharkunik region, south-west from Lake Sevan, at 7km distance from Sevan National Park, at 75 km from the regional center Gavar town and at 170km from Yerevan. The city is located in Masrik plain at 2003 m absolute elevation.

Geghhovit village is located in southern part of Lake Sevan, at 2060 m absolute elevation and spreads on the two banks of the Martuni river. It is located at 37 km south-east of the the regional center Gavar town. The climate of this area is conditioned by the influence of Lake Sevan; it is temperate, with long cold winters and short, cool summers.

Absolute maximum air temperature is 33^0C. Absolute minimum air temperature is -32^0C: Annual precipitation is 588mm, north and north-eastern winds of 3.2m/sec velocity predominate here. During 20 years winds of 27m/sec velocity are possible. Snow cover thickness reaches 163cm.

Climate change effects are forecasted in this region, related to the increase in evaporation from Lake Sevan and reduction of the river flows into the lake, conditioned by temperature increase.

Maximum land freezing depth is 114cm.

Climate change effects in this area are related to Lake Sevan. According to information provided in the National Climate Change Reports, Armenia's water resources and, in particular, Lake Sevan are vulnerable to the effects of climate change, which is the result of the increase in temperature and the evaporation from the lake surface and the reduction of the flow of rivers flowing into the lake.

The number of population of Vardenis town and Geghhovit village, according to the RA National Statistical Service web site as of 01.01.2016 is about 19000.

5.2. GEOLOGY OF THE STUDIED AREA

Vardenis town and Geghhovit village are located in Lake Sevan basin, in Martuni and Vardenis regions. The settlements are mainly speed on the volcanic plateau of Vardenis mountains, on eroded-weathered slopes, lacustrine-sedimentary (former lake section), and river valley (the Rivers of Martuni and Marmarik) hill zones.

From orographic point of view the Vardenis town is located in the zone of Vardenis mountain ridge. From geomorphologic point of view it is located on eroded-weathered slopes, The relief represents upper floodplain terraces and river valleys.

The geological structure of the area is represented by volcanic and volcanic-sedimentary rocks, such as porphyrite, tuff breccia etc. volcanic formations of Pliocene Miocene age. The layers are covered with Quaternary alluvial origin formations - clay, sand and coarse clastic rocks; their thickness exceeds 18.0 m in some cases.

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

- Water bearing complex of deluvial-proluvial sediments;
- Complex of Quaternary lava sediments;
- Complex of metamorphic and volcanic-crushed rocks.

Among dangerous physical-geological phenomena are stone falls, stone slides, flooding in riparian zone, side and bed erosion in beds. Intense shore deterioration processes take place along the whole length of Lake Sevan shore. Silty rocks are corrosive to the concrete media.
The main soil types common in the region are: mountain brown, mountain black soils, mountain-forest, and brown soils.

5.3. BIODIVERSITY

Vardenis town and Geghhovit village are located in Lake Sevan basin, at 7-10 km away from the Sevan National Part bordering area. This area is notable for its unique and rich biodiversity, geological and landscape complexes and their separate components. Sevan basin geographical position, unique climate and variety of flora have created a suitable environment for fauna.

Flora

The area is located in Sevan floristic region. It includes unique and endangered and endemic species of Armenian flora. In Lake Sevan basin there are 23 plant species endemic to Armenia, 13 of which are endemic to Sevan floristic region.
In the area of the settlements included in the package, mainly xerophilous sparse forest plants occur, mainly Juniperus polycarpos K.Koch. Among the wild useful plants are L. marrubiastrum, Origanum Vulgare L. Hyoscyamus niger, Urtica dioica L., Melilotus officinalis, etc.

Hyoscyamus niger

Melilotus officinalis

There are not Red Book plant species in the area.

Fauna

Among the representatives of the fauna are an jungle cats, jackals, rabbits, wild pigs, partridges, quails. Among the species written in the Red Book are grapefruit pelicans (Pelecanus crispus), Marmara Murmus or Marmaronetta angustirostris, Armenian whiteberries.

Pelecanus crispus

Marmaronetta angustirostris

Biodiversity of direct impact area

The area directly impacted by the Vardenis water supply system improvement includes the following sections:

- The area of Akunk springs located in the village of Akunk (construction of chlorination station and contact reservoir), which belongs to the Water Company and is a fenced area; the area adjacent to N1 school in Vardenis (construction of pumping station) where the community's football field is located.
- The water main passage area from Akunk springs to the newly constructed pumping station (construction of a new water main along the Akunk-Vardenis inter-community road).
- The area of Vardenis town's DRR (repair of DRR, construction of chlorination station), the area belongs to the Water Company; it is fenced.
- The area for the construction of the water main, which begins from the DRR and runs to the distribution network, passing through the formerly uncultivated land belonging to the community.
- The area of 2 multi-apartment districts (construction of distribution network).

The area directly impacted by the Geghhovit village water supply system improvement includes the following sections:

- The areas of "Yanagh" and "Mkhedzor" springs (repair and reconstruction of spring intakes, construction of a water intake) that belong to the community.
- Construction of a chlorination station (near the 79th km of the Sevan-Martuni Getap Republican Highway, in the administrative territory of the village, in uncultivated land for communal purposes) and a pressure reducing chamber.
- The area of DRR (repair of the DRR), a community ownership area. Residential area of the village (construction of distribution network), where there is no wild vegetation and fauna.

Thus, the area of the project implementation does not include habitats of flora and fauna species, and there are no negative impacts on flora and fauna during construction and operation.

Water ecosystems

Geghhovit village is located on both banks of Martuni rivulet. It starts from Vardenis mountain range north slopes at 3300m altitude. It is 27,6km long, catchment basin is 101km^2 . Its feeding is mainly from snow melts and rains (58%), floodings in April-May. The water of the river is used for irrigation purposes. A fast mountain river. In summer it is dry.

The design water lines of the distribution network cross the rivulet at three places. The crossing is implemented by span over the supports of the bridges. About 1.7km of the water lines of the distribution network are passing along the earth streets parallel the river, at about 10-20m distance from the river bank.

The Yanagh springs are located near Argichi river Gayladzor tributary.

Specially protected nature areas

The nearest specially protected area is Sevan National Park. It was founded in 1978 and is located at 1890-3597m altitude above sea level. The Park has scientific, conservation, administrative-economic and recreation departments and 4 branches. The main objectives of its activity are protection of natural ecosystems and landscapes of the area, biodiversity protection and restoration, ensuring targeted use of natural resources and cultural and historical monuments. "Sevan" National park is located at 7 km distance from the impact area and will not be subject to any impact during the project implementation.

Historic-cultural monuments

Vardenis town is one of the oldest settlements of Armenia. Dozens of tombs of the Bronze Age are discovered here. St. Mary Church was built in 1902-1910; there are graves, ornate stone crosses and tombstones in its courtyard (15-18th centuries).

There are many archeological sites in the vicinity of the Geghhovit village, such as the fortress "Albert" (first millennium BC, IX centuries BC) in the western part "Joj kogh" fortress in the south-eastern part (2-1 millennium BC).

St. Gevorg (XV-XVI centuries) and St. Stepanos (XIII century) churches, as well as "Tukh Manuk" chapel are located in the village.

No negative impact on these monuments is expected during the implementation of the project.

6. ENVIRONMENTAL AND SOCIAL IMPACTS

As a result of the works aimed at the improvement of water supply systems of Vardenis town and Geghhovit village, the expected positive environmental, climate and social effects are as follows:

- water resource protection and sustainable use,
- reduction of water losses,
- introduction of water metering system,
- increasing water consumption efficiency,
- providing high drinking water quality,
- increasing duration of water supply to population,
- preventing, excluding penetration of infectious agents in drinking water;
- reduction of drinking water pollution hazard,
- improvement of health condition of population.

The activities carried out under this package will have a noticeable positive impact on the social condition of the inhabitants of Vardenis and Geghhovit communities. 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 19000 people.

The introduction of water metering system will reduce the amount of water supplied and reduce the consumed water quantity (the collection of fees for the water used will result in effective water use and reduced water consumption, and 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 but is refreshed 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.

In Vardenis and Geghhovit communities the water lines pass through earth roads, and the main impact during the construction will be the disturbance of inter community roads.

During the rehabilitation of the Yanagh catchments and water intake chamber pollution of Gayladzor tributary with construction and household wastes and ecosystem disturbance is possible.

Possible risks during the replacements of water supply networks and implementation of inlet lines for individual houses include temporary cutting of water supply to the inhabitants, safety of inhabitants and workers, disturbance of pavements and roads, air pollution with dust, noise. In Geghhovit village there may be impacts on Martuni river ecosystem, as in the village the water lines will cross the river in three places (the span will be implemented upon the supports of the

bridges), and about 1.7km of the water line passes along the earth road at 10-20m distance from the river.
The possible negative impact might be mainly caused by construction works implementation, and expected to do little damage and be temporal.
The following negative environmental and social impacts are expected during the construction works:

- Air pollution
- Soil erosion and sediment transport in sloped areas
- Pollution of environment and with construction and household waste
- Pollution of soil and water resources with fuels and lubricants
- Water and soil pollution with chlorine
- Noise and vibration
- Temporary disturbances to roads of the communities
- Disturbance of road and pedestrian roads within the communities and increase of traffic load
- Ignoring safety measures for employees and residents

To minimize or prevent the negative impacts, mitigation measures were envisaged and an Environmental and Social Management Plan (ESMP) plan was developed, which should be followed by the contractor, control and supervision units.
The EMP is an integral part of the environmental assessment document and are included in working drawings.

6.2. ENVIRONMENTAL IMPACT MITIGATION MEASURES

Adverse impacts on the environment and human health while implementing construction works for improvement of water supply systems of Vardenis town and Geghhovit village are possible during the construction of: (i) trenches for water lines, (ii) pits for regulating and water metering nodes, (iii) construction/reconstruction of spring intakes, water intakes, 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 soil erosion and sediment transport, the following is to be implemented: in inclined sites of the water line routes implement measures for retaining the inclinations; minimize the time during which trench and pit excavations for regulation and metering nodes, 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 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 *water ecosystem disturbance* and to exclude the pollution of the river as a result of reconstruction of Yanagh catchments and water intake chamber, the fuels and lubricants shall be stored at least 50m far from the river, in tanks. The used lubricants will be collected in special containers and removed from the construction site. The construction and household waste will be collected and removed from the area on daily basis.

To exclude river pollution from construction waste and the disturbance of the river banks and river bed when implementing the water main spans over the river.

To exclude river pollution with construction materials the materials will be put at least 30-50m far from the trench and at least 40-70m from the river bank (the trench is designed to be implemented at 10-20m distance from the river bank). Household waste will be removed from the construction site on daily basis.

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.

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 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.
To 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 (in the initial assessment phase);
   - 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 EMP, 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.

- ***Controlling agencies, which are responsible for controlling the executive units to provide implementation of the EMP 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 EMP. 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 EMP 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 EMP implementation.

- ***State monitoring agencies, which are responsible for observing the extent and efficiency of EMP 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 EMP 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

The EMSP will be based on the results of IEE prepared by subproject and will include appropriate mitigation measures.
EMSP 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 EMSP. The costs foreseen for the implementations of all the measures prescribed in the EMSP 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 and social management 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 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" versions considered, in case of which no work is done in the above-mentioned communities. As a result of leaving the water supply systems of Vardenis town and Geghovit village in the same condition, we have huge losses of water resources, water metering system is not introduced in the village, qualitative and quantitative requirements for drinking water are not met, multi-apartment buildings of the town are not provided with water, residents have health and social problems.

Table 2. Environmental and Social management and monitoring plan

Works and possible impacts	Proposed mitigating measures	Monitoring	Works and possible impacts
Construction			
1. *Air pollution in the settlements*	– Install fencing around the construction site. – Regularly water the construction site and the roads to the construction site. – Provide body cover for trucks. – Do not accumulate and burn waste on the construction site.	Daily site inspection	Contractor, Consultant, PIU
2. *Soil erosion and sediment transport*	- In inclined sites of the water and sewerage line routes implement measures for retaining the slope. - Minimize the time during which trench and pit excavations for water and sewerage lines, regulation and metering nodes are open. - Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design	Daily inspection of construction site	Contractor, Consultant, PIU
3. *Topsoil layer or sediment transport* at slopy areas of water main installations	- Remove and store the topsoil on the assigned site, at 300-500m from the construction site. - Cleaned the construction site from the household and construction waste. - Provide the previous state of landscape.	Daily inspection of construction site	Contractor, Consultant, PIU
4. *Land and water resources pollution (rivers flowing within the settlements) with*	- Store oil, fuels and lubricants on a sealed surface, away from water resources. - Allot isolated areas for the repair and charging of machinery, equipment with lubricants.	Daily inspection of construction site	Contractor, Consultant, PIU

Works and possible impacts	Proposed mitigating measures	Monitoring	Works and possible impacts
fuels and lubricants	- Plan specially designed storage tanks for the used lubricants, which will be subsequently removed to specific locations or to special sites for recycling.		
5. *Environment and water ecosystem 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. - Exclude discharge of construction waste into the river during laying of water supply pipes over bridges, as well as during the construction of water lines along the river in Geghhovit. - Install waste collection tanks in the construction sites and collect and remove them daily from the construction site. - Exclude the burning of household waste in the site.	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
6. *Land and water resources pollution with chlorine*	- Implement disinfection of water mains and distribution network with chlorine, according to technical calculations. - Provide appropriate technical means for removal of chlorine water from washing. - 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.	During washing of pipelines	Contractor, Environmental inspectorate, Consultant, PIU
7. *Noise*	- Limit night work in residential areas, - Avoid usage of machines/equipment with extra noise. - Install silencers if needed.	Daily inspection of construction site	Contractor, LGB, Consultant, PIU
8. *Troubles and Dangers*	- Implement the construction in phases, inform the population about the	Daily inspection of	Contractor, LGB,

Works and possible impacts	Proposed mitigating measures	Monitoring	Works and possible impacts
to Population	works. - Install appropriate traffic signs, barriers. - Organize by-passes. - Mark the construction areas (trenches) with safety ribbons, - Ensure participation of the population in the implementation of the project, which will minimize the disruption of the social activity.	construction site	Consultant, PIU
9. Hazards for Workers	- Install fencing around construction site. - Control access of unauthorized persons to the site. - Place warning signs in dangerous places - Carry out regular examination of equipment by highly qualified staff, - Make regular safety audits of equipment. - Provide first aid and safety training to construction staff. - Provide workers with means necessary for work (overall, shoes, caps, earplugs, respirator masks, etc.)	Daily inspection of construction site	Contractor, LGB, Consultant, PIU

APPENDIX 1

Record of Interagency and Consultation Meetings

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

APPENDIX 2

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 3

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 4

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
WWTP	Wastewater treatment plant
SNIP	Construction norms and rules
IESE	Initial Environmental and Social Examination
JV	Joint Venture