Initial Environmental Examination

May 2013

ARM: Water Supply and Sanitation Sector Project — Additional Financing

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WATER SUPPLY AND SANITATION SECTOR ADDITIONAL FINANCING FUNDED BY THE ASIA DEVELOPMENT BANK

Date of preparation - 25.04.13

IMPROVEMENT OF ARMENIA SETTLEMENTS WATER SUPPLY AND SANITATION SYSTEMS

INITIAL ENVIRONMENTAL EXAMINATION

IV SUBPROJECT: IMPROVEMENT OF WATER SUPPLY SYSTEMS IN KOTAYK MARZ SETTLEMENTS
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1. BACKGROUND OF THE PROJECT

WSSP Project will improve public health and environment for about 400,000 people (households and other consumers) living in 18 towns and up to 92 villages1 through safe, reliable and sustainable water supply. The outcome of the Project is improved access to safe, reliable, and sustainable WSS services 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 participate more 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 towns and villages by improving their access to safe and sustainable drinking water.

Similar to the original WSSP, the Additional Financing Project will fund two project components which include: (i) municipal infrastructure rehabilitation and improvement; and (ii) management improvement and development which include gender features.

2. ENVIRONMENTAL AND SOCIAL SAFEGUARD DOCUMENTS

In accordance with the ADB Environmental policy (November , 2002) the Subproject is ranked to B category which does not need extended EIA, excluding either Environmental expertise, according to the RA law on “Environmental Impact Assessment ” (issued on November 20, 1995.) and the RA Government decree “Threshold of environmental impact activities subject to expertiz ” (N-193, 30 March 1999).

As a B Category Project ADB Policy required development of Initial Environmental Examination/ IEE reports for each Subproject (1 report) and site specific Environmental Management Plan/EMP (separate report for each lot of the subproject).

3. SCOPE OF WORKS

This subcomponent of the subproject aims at the improvement of water supply systems of Hrazdan and Tsakhkadzor towns and adjacent 2 rural communities (Qaxs, Akunq) of RA Kotayq Region, included in the frame of the project.

Priority has been given to the improvement of water supply systems, the purpose of which the following works have been carried out:

**t.Hrazdan**

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1 The number of towns and villages may change subject to further detailed assessments.
- Replacement of inter district main pipelines of distribution network with polyethylene pipes of de100-de225 diameters, approximately 19.5 km total length.
- Replacement of entry lines of total 115 multi-apartment buildings, polyethylene pipes of de63-de100 diameters, with approximately 4.3 km total length,
- Replacement of entry lines of total 365 private houses and 142 economic entities, with polyethylene pipes of de20-de32 diameters, with total 4.4 km length.

**t. Tsakhkadzor**
- Construction of external pipeline with polyethylene pipes of de250 diameter, with approximately 1.6km total length
- Demolition of existing 400m$^3$ capacity emergency DRR of Writers house and construction of new one (W=1000m$^3$)
- Replacement of distribution network with polyethylene pipes of de63-de160 diameters, with approximately 2.5 km total length.
- Dismantling of 2 pumps with the powers of $Q=30\text{l/sec}$ in the “Maqravan-4” pumping station and installation of more powerful $Q=50\text{l/sec}$ new pumps.

**v. Qaxs**
- Replacement of inter district main pipelines of distribution network with polyethylene pipes of de63-de100 diameters, approximately 10.5 km total length.
- Replacement of entry lines of total 115 multi-apartment buildings, polyethylene pipes of de63-de100 diameters, with approximately 4.3 km total length,
- Replacement of entry lines of total 295 private houses, with polyethylene pipes of de20-de32 diameters, with approximately 2.4 km total length.

**v. Akunq**
- Replacement of distribution network with polyethylene pipes of de63-de160 diameters, with approximately 12 km total length.
- Construction of new pipeline from pumping station to 500m$^3$ capacity DRR, with approximately 1.2km length.
- Construction of entry lines of total 295 private houses
- Reconstruction of water supply deep well.

Population of the Subproject at the date of 01.01.2012 was 56400 people in Hrazdan town, 3500 people in Tsaxkadzor town, 2550 people in Qaxs village, and 2200 people in Akunq village. Total number of consumers is 17333, 1023 of which are the consumers of the village settlements.

According to the data published by the Demographic Handbook of Armenia 2012 the population is 0.43%:
Due to the project implementation, it is planned to provide drinking and sustainable water supply to the consumers of the communities.

4. DESCRIPTION OF THE CURRENT WATER SUPPLY AND SANITATION SYSTEM

4.1. Description of the water supply systems

The water supply and sewage systems of all settlements included in the Subproject are served by “Armwatersewerage” CJSC. Hrazdan and Tsakhkadzor towns and also Qaxs rural community are located in Kotayq Region’s Hrazdan area, where the total level of leakages forms approximately 87%. Akunq rural community is located in the region’s Abovyan area, where the total level of leakages is about 82%.

The water supply of Hrazdan town is done passing through town area, in Hrazdan river coastal, located at 1700-1705m elevation marks “Maqravan” springs: through “Maqravan-2” and “Maqrava-3” pumping stations, whose cumulative power makes approximately 1350-1400l/sec.

For town potable and household purposes, estimated daily average water demand makes 22000m$^3$/day, taking into consideration the normative permissible 20% leakages.

Through pumping stations existing in the “Maqravan” springs area, except Hrazdan town, currently also is done water supply of Abovyan and Tsakhkadzor towns.

During 2010-2011yy with the World bank financing, in the distribution network of Hrazdan town various works have been implemented connected with the installation of water metering new hubs, construction and replacement of pipelines, entry lines of private houses and multi-apartment buildings.

As a result of implemented works in the Hrazdan town despite of 30% decrease in supplied water and existing 82% leakages in the distribution network, currently the water supply average duration is about 15 hours.

Despite of works carried out during last years for sanitary condition improvement of water supply and aqueduct buildings, however accidents of pipelines and sewerage lines are recorded.

The water supply and sewage systems of Tsakhkadzor town are served by “Armwatersewerage” CJSC. Currently the water supply of the town is mainly performed through “Maqravan-4” pumping station. However Tsakhkadzor town has also 2 other water supply systems: Texenis and Sport base, which powers respectively are 0-15l/sec and 0-5l/sec. However these sources have seasonal character, as in low water months (September-February) completely are dried up. The water supply is mainly done through “Maqravan-4” pumping station, after water disinfection. In Tsakhkadzor currently are operating 7 daily regulation reservoirs, which cumulative volume is 3400m$^3$.

The operating water supply system was mainly constructed 30-40 years ago, and is in not favorable condition. However during last years, with the World Bank financing, some works have been
implemented in the town connected with the construction of new pipelines, replacement of private houses entry lines, reconstruction of DRRs and construction of new chlorine station. Anyway these works are not enough, because according to the existing data leakages yet are more than 50% and the distribution network of the town is partially zoned.

The water supply of Qaxs rural community is performed passing through village area and feeding from Maqravan-Abovyan DN700 diameter main pipeline, pumping station, which was constructed in 2007. From pumping station water is pumped into the new 300m³ capacity DRR near Yervan-Sevan freeway, which was constructed in 2011-2012yy with the ADB financing program.

As a result of implemented works during 2011-2012yy, the external water supply system of Qaxs village currently is in normal conditions. However the general water supply of the village is in extremely miserable condition, with the existence of collapsed pipelines and emergency conditions of distribution network, as a result of which the level of leakages reaches 95%. The fact that the main buildings of water supply systems have no sanitation zones is distressing.

The water supply of Akunq rural community is done through 3 deep spontaneous (artesian) wells after disinfection, located in the village are. The cumulative outcome of deep wells makes approximately 40l/sec. They are located in the lower areas of the village, at 1445-1448m elevations, 300-350m far from each other. Near each deep well water intake reservoirs with the 10-15m³ capacity and small pumping stations are constructed, from which two are in a dilapidated condition. The DRR with the capacity of 500m³, which is located in the upper part of the village at 1485.0m elevation, is in normal condition; however mainly it does not operate, as from 3 pumping stations pumped 40l/sec general water is directly given to the village distribution network.

The distribution network of the village is in emergency condition. Because of existing huge leakages, some upper parts of the village during daytime have no water supply, despite the fact that the 40l/sec water quantity exceeds approximately 5 times the real water demands of the village.

4.2. Description of the sanitation system

All the investigated settlements have sewage system, however the sewage lines normally do not function. Hrazdan town does not have wastewater treatment station, and the cleaning station of Qaxs does not operate since 1993.

There are blocked parts in the main collector of the sewage system and inter district drainage network, some wells need a reconstruction and manhole replacement.

Because of the absence of treatment plants and sewage lines accidents, the wastewater is removed through Hrazdan and Marmarik rivers: moved till Axpara basin. The wastewater of Tsakhkadzor town is removed through Hankavan-Hrazdan collector, however they fall in to the river without cleaning.
The question about wastewater of operating resort Houses and Sanatoriums is also actual, which without preliminary cleaning and disinfection are falling into the nearby rivers or are passing into the ground.

Exist also removal of wastewater through open rills, which cause environmental pollution.

5. GEOGRAPHICAL LOCATION AND CLIMATE OF THE SETTLEMENTS

All settlements covered by the subproject belong to RA Kotayq region, which area is 2076km2. The centre of the region is town Hrazdan, which is 45km away from capital Yerevan.

The area is included in the cold climatic zone and is characterized by cool summer and very cold winter, where in July and August the monthly average temperature is 17.20C. Yearly average temperature is 5,20C. The coldest month of the year is January, the warmest July. Air absolute maximum temperature is +33ûC, absolute minimum is -31ûC, air relative humidity is 71%.

According to Hrazdan meteorological station observations annual precipitations is 588mm. Precipitations mainly occur in March-June months. In summer north-easterly direction and in winter south-westerly direction winds are dominating. The maximal snow cover in ten-day period reaches 132cm. The ground freezing depth is 0.96m.

Mentioned settlements are located on right and left sides of Hrazdan River, where the surfaces are uneven and have volcanic Plateau typical, hill-dam relief. The absolute elevations vary between 1700-1708m.

From orographic view point the area’s biggest rivers are Hrazdan and its right confluent Marmarik, with their numerous temporary and permanent flows.

The studied areas are located on the left sided and right sided valley of Hrazdan river upper stream and its nearby places.

From geomorphological point of view the area is located in the south-eastern verge of Tsaxkunianc mountain range, which from East part is limited by north-western verge of Gexama mountains, which are surrounded by low hill-ranges and not deep concavities.

The Geological structure is diverse. Here are meeting average quaternary aged basalts and andesite volcanic flows, lower Eocene limestone and sand-stone sediments, also chalk aged limestones and margas, which are coverd with modern delluvial-proluvial, and due to Hrazdan river activities, lake-alluvial formations, with quite different capacities.
In the area among the exogen geological phenomena there are surface erosion, deepening and changing of riverbed in the ravines of permanent and temporary streams as a result of atmospheric precipitations, technogen phenomena, etc., which need to be more detailed investigated and examined in the course of further work.

The area has got 0.3g acceleration and is situated in region of possible earthquakes of 8-9 scale.

6. BIODIVERSITY AND NATURAL SPECIAL PROTECTED AREAS

The settlements of RA Kotayq region are rich with historical and cultural heritage, which stimulus for tourism and recreation zone development in the region.

Taking into consideration the region’s rich biodiversity, unique forest landscape and ecosystems protection necessity: in Kotayq Region have been formed “Banks' pine”, “Arzakan-Meghradzor”, “Hankavan” reserves and “Erebuni” reserve.

In the region are spread wild Poaceaes, and “Erebuni” reserve which is also in Kotayq region, is considered as Poaceaes genofond conservation hotbed.

Region has rich and diverse vegetation, it is located on dry mountain heath and wormwood semi desert borderline.

The plant coexistences are widely spread, which are mainly formed from yearling poaceaes: Aegilops cylindrica, Amblyopyrum muticum, Secale Vavilovii, Triticum araraticum, T. Boeoticum, T. Urartu and etc. Here are more than hundred types of wheat. Here also are meeting other rare and endangered species, which are recorded in the RA Red Book. Among them are Iris reticulata, Rhizocephalus orientalis, Hohenackeria excapa, Cundelia tournefortii and etc.

The animal world is rich and diverse. Here are meeting various types of reptiles, from which are Macroviipera lebetina, Malpolon monspesscullanus, Mabuya aurata, Eumeces schneideri and etc. From the amphibious are meeting Rana ridibunda, Bufo viridis, Hyla savigna. The forest zone bird world is presented mainly with about 40 type sparrow bird species. Among them are remarkable Coturnix coturnix, Perdix perdix, Streptopelia turtur, Falco tinunnculus, Circus macrourus, Athene noctua, Coracias careulus and etc. Species of mammals are forest mouse, fox, wolf, gray bear, boar, weasel, rarely also marten and badger.

Though the existence of cultural heritage spiritual institutions in the communities of the subproject (such as Kecharis Monastery in Tsakhkadzor, 11-13th centuries), however the subproject does not deal with the latter.

In the subproject implementation areas, there are no environmental harming and special natural protection places.
7. ENVIRONMENTAL IMPACT

Initial Environmental Examination (IEE) has revealed that no damage is expected to be caused to the landscape, flora, fauna, land and water resources of the area where works on improvement of the water supply systems will be implemented.

The sub-project will be implemented mainly in the urban areas of the settlements, and new areas will not be used for the purposes of the works implementation.

As to the preliminary environmental inspection the sub-project was classified as B category project. Along with the Detailed Design an Environmental Management Plan has to be elaborated for this project, which shall cover all the communities that are included in the Detailed Design.
7.1. Rapid Environmental Assessment (REA) Checklist

Country/Project title: Armenia Water Supply and Sanitation Sector Project-Additional Financing

Sector division: SUBPROJECT IV.1- RA KOTAYQ Region – Hrazdan town, Qaxs village

<table>
<thead>
<tr>
<th>Screening Questions</th>
<th>Yes</th>
<th>N/A</th>
<th>No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Project Siting</strong>&lt;br&gt;Is the project area…</td>
<td></td>
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<tr>
<td>densely populated?</td>
<td>+</td>
<td></td>
<td></td>
<td>Kotayq region considered as one of the most densely populated regions of Armenia, 134,3 people/square km</td>
</tr>
<tr>
<td>heavy with development activities?</td>
<td>+</td>
<td></td>
<td></td>
<td>Both 2 town settlements have urban development project documentation (master plans). In Hrazdan town construction works are partly implemented, however they are not overloaded with development actions. In rural settlements there is no such a problem.</td>
</tr>
<tr>
<td>adjacent to or within any environmentally sensitive areas?</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cultural heritage site</td>
<td>+</td>
<td></td>
<td></td>
<td>Almost all settlements have cultural heritage monuments, but the project does not deal with them</td>
</tr>
<tr>
<td>protected Area</td>
<td>+</td>
<td></td>
<td></td>
<td>“Erebuni” reserve is located between Mushaxbyur and Gexadir villages of Kotayq region, 58km far from Hrazdan town</td>
</tr>
<tr>
<td>marsh</td>
<td>+</td>
<td></td>
<td></td>
<td>There are no marshes during project implementation</td>
</tr>
<tr>
<td>mangrove</td>
<td>+</td>
<td></td>
<td></td>
<td>There are no such kind of areas in Armenia</td>
</tr>
<tr>
<td>estuarine</td>
<td>+</td>
<td></td>
<td></td>
<td>Hrazdan town and Qaxs rural settlements are located on right and left sides of Hrazdan river</td>
</tr>
<tr>
<td>buffer zone of protected area</td>
<td>+</td>
<td></td>
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</tr>
</tbody>
</table>
### B. Potential Environmental Impacts
Will the Project cause…

<table>
<thead>
<tr>
<th>Screening Questions</th>
<th>Yes</th>
<th>N/ A</th>
<th>No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ special area for protecting biodiversity</td>
<td></td>
<td></td>
<td></td>
<td>“Banks’ pine”, “Arzakan-Meghradzor”, “Hankavan” reserves are located 10-15 km far from Hrazdan town</td>
</tr>
<tr>
<td>▪ bay</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?</td>
<td></td>
<td></td>
<td></td>
<td>water supply is foreseen from ground waters</td>
</tr>
<tr>
<td>▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?</td>
<td></td>
<td></td>
<td></td>
<td>All settlements have cultural heritage monuments, but the project does not deal with them</td>
</tr>
<tr>
<td>▪ hazard of land subsidence caused by excessive ground water pumping?</td>
<td></td>
<td>+</td>
<td></td>
<td>It is not applicable to this subproject</td>
</tr>
<tr>
<td>▪ social conflicts arising from displacement of communities?</td>
<td></td>
<td>+</td>
<td></td>
<td>Not anticipated</td>
</tr>
<tr>
<td>▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?</td>
<td></td>
<td></td>
<td></td>
<td>In the frame of the subproject potable water supply will be done from underground sources. The drinking water shall not be used for irrigation or any other purposes.</td>
</tr>
<tr>
<td>▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?</td>
<td></td>
<td></td>
<td></td>
<td>In the frame of the subproject potable water supply will be done from underground sources, after treatment.</td>
</tr>
<tr>
<td>▪ delivery of unsafe water to distribution system?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ inadequate protection of intake works or wells, leading to pollution of water supply?</td>
<td></td>
<td></td>
<td></td>
<td>Within the frame of this subproject in the main buildings works are not designed.</td>
</tr>
<tr>
<td>▪ over pumping of ground water, leading to salinization and ground subsidence?</td>
<td></td>
<td>+</td>
<td></td>
<td>The design doesn’t foresee pumping of ground water, that is why the implementation of the design cannot result insalinization and ground subsidence</td>
</tr>
<tr>
<td>▪ excessive algal growth in storage reservoir?</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening Questions</td>
<td>Yes</td>
<td>N/A</td>
<td>No</td>
<td>Remarks</td>
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<tr>
<td>▪ increase in production of sewage beyond capabilities of community facilities?</td>
<td></td>
<td></td>
<td></td>
<td>In the settlements included in the subproject sewage cleaning stations are missing, and the existing ones do not operate</td>
</tr>
<tr>
<td>▪ inadequate disposal of sludge from water treatment plants?</td>
<td></td>
<td></td>
<td></td>
<td>Not applicable for the subproject</td>
</tr>
<tr>
<td>▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?</td>
<td></td>
<td></td>
<td></td>
<td>Project documentation is prepared according to acting urban development norms.</td>
</tr>
<tr>
<td>▪ impairments associated with transmission lines and access roads?</td>
<td></td>
<td></td>
<td></td>
<td>Impairment associated with access roads, and crossings with transmission lines will be carried out according to the required norms</td>
</tr>
<tr>
<td>▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.</td>
<td></td>
<td></td>
<td></td>
<td>All design documents for all structures are prepared according to acting urban development and sanitation norms.</td>
</tr>
<tr>
<td>▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?</td>
<td></td>
<td></td>
<td></td>
<td>While working with chlorine or other contaminants prescribed technological procedures shall be followed.</td>
</tr>
<tr>
<td>▪ dislocation or involuntary resettlement of people?</td>
<td></td>
<td></td>
<td></td>
<td>Not foreseen</td>
</tr>
<tr>
<td>▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?</td>
<td></td>
<td></td>
<td></td>
<td>Not foreseen</td>
</tr>
<tr>
<td>▪ noise and dust from construction activities?</td>
<td></td>
<td></td>
<td></td>
<td>During construction it will have temporary character and mitigation measures will be developed in EMP (Environmental Management Plan).</td>
</tr>
<tr>
<td>▪ increased road traffic due to interference of construction activities?</td>
<td></td>
<td></td>
<td></td>
<td>Not significant increase is predicted for the construction period.</td>
</tr>
<tr>
<td>▪ continuing soil erosion/silt runoff from construction operations?</td>
<td></td>
<td></td>
<td></td>
<td>Detailed measures of construction management will be described in the EMP</td>
</tr>
</tbody>
</table>
### Screening Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>N/A</th>
<th>No</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ delivery of unsafe water due to poor O&amp;M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?</td>
<td></td>
<td></td>
<td></td>
<td>+ Mud accumulation issue is not applicable. Monitoring of chlorine residuals in distribution system will be performed according to established procedure.</td>
</tr>
<tr>
<td>▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?</td>
<td></td>
<td></td>
<td></td>
<td>+ During operation of this system corrective chemicals for water treatment are not used.</td>
</tr>
<tr>
<td>▪ accidental leakage of chlorine gas?</td>
<td></td>
<td></td>
<td></td>
<td>+ In the case of technical security providing it is not anticipated.</td>
</tr>
<tr>
<td>▪ excessive abstraction of water affecting downstream water users?</td>
<td></td>
<td></td>
<td></td>
<td>+ The design of the system reconstruction is developed to exclude such cases.</td>
</tr>
<tr>
<td>▪ competing uses of water?</td>
<td></td>
<td></td>
<td></td>
<td>+ The project aims at softening competition in water uses.</td>
</tr>
<tr>
<td>▪ increased sewage flow due to increased water supply</td>
<td></td>
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<td></td>
<td>+</td>
</tr>
<tr>
<td>▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant</td>
<td></td>
<td></td>
<td></td>
<td>+ No any settlement covered by the Project has waste water treatment plant</td>
</tr>
<tr>
<td>▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?</td>
<td></td>
<td></td>
<td></td>
<td>+ The volume of the project is small and it focused at reconstruction of existing systems, new casual impacts are anticipated.</td>
</tr>
<tr>
<td>▪ social conflicts if workers from other regions or countries are hired?</td>
<td></td>
<td></td>
<td></td>
<td>+ Mainly local labor force will be involved.</td>
</tr>
<tr>
<td>▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?</td>
<td></td>
<td></td>
<td></td>
<td>+ If safety measures of explosives, fuels and other chemicals used within the framework of the project are maintained, risks will be minimized.</td>
</tr>
<tr>
<td>▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?</td>
<td></td>
<td></td>
<td></td>
<td>+ If safety measures of associated with the transport, storage and use of explosives, fuel and other chemicals used within the framework of the project are maintained, community safety risks due to both accidental and natural hazards</td>
</tr>
<tr>
<td>Climate Change and Disaster Risk Questions</td>
<td>Yes</td>
<td>No</td>
<td>Remarks</td>
<td></td>
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<tr>
<td>-----------------------------------------------------------------------------------------------------------</td>
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<td>--------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?</td>
<td>+</td>
<td></td>
<td>Armenia located in active tectonic zone with all possible consequences</td>
<td></td>
</tr>
<tr>
<td>▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?</td>
<td>+</td>
<td></td>
<td>Decline of precipitations may cause decrease of water source discharge, which in its turn will lead to disruption of sustainable water supply</td>
<td></td>
</tr>
<tr>
<td>▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g., high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

* Hazards are potentially damaging physical events.
“WATER SUPPLY AND SANITATION SECTOR PROJECT – ADDITIONAL FINANCING FINANCED BY ASIAN DEVELOPMENT BANK”

Date of preparation 20.05.13

IV SUBPROJECT - IMPROVEMENT OF WATER SUPPLY SYSTEMS IN KOTAYK MARZ SETTLEMENTS

Package IV.1 – Hrazdan town and Qaghsi village

ENVIRONMENTAL MANAGEMENT PLAN
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LIST OF ABBREVIATIONS

RA MoNP - RA Ministry of Nature Protection
RA MoH - RA Ministry of Healthcare
RA MT&C –RA Ministry of Transport and Communication
RA MoC - RA Ministry of Culture
JV - Joint Venture
LSGB – Local Self-Governmental Bodies
EIA - Environmental Impact Assessment
AWSC/ADB PMU – Armenian Water Sewage Company/Project Management Unit of Asian Development Bank
EMP- Environmental Management Plan
IEE- Initial Environmental Examination
DD – Detail Design
1. BACKGROUND OF THE PROJECT

WSSP Project will improve public health and environment for about 400,000 people (households and other consumers) living in 18 towns and up to 92 villages through safe, reliable and sustainable water supply. The outcome of the Project is improved access to safe, reliable, and sustainable WSS services 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 participate more 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 towns and villages by improving their access to safe and sustainable drinking water.

Similar to the original WSSP, the Additional Financing Project will fund two project components which include: (i) municipal infrastructure rehabilitation and improvement; and (ii) management improvement and development which include gender features.

2. ENVIRONMENTAL AND SOCIAL SAFEGUARD DOCUMENTS

In accordance with the ADB Environmental policy (November, 2002) the Subproject is ranked to B category which does not need extended EIA, excluding aslo Environmental expertise, according to the RA law on “Environmental Impact Assessment ” (issued on November 20, 1995.) and the RA Government decree “Threshold of environmenttal impact activities subject to expertiz ” (N-193, 30 March 1999).

As a B Category Project ADB Policy requered development of Initial Environmental Examination/IEE reports for each Subproject (1 report) and site specific Environmental Management Plan/EMP (separetly report for each lote of the subproject).

3. INTRODUCTION

This very report is developed for the Subproject on the Improvement of W&W Systems in Hrazdan town and Qaghsi village of the RA Kotayq marz, the design of which has been performed by JV of “HGSN” and “JINJ” LLCs. The Water supply systems rehabilitation involves activities on reconstruction and repair of water distribution systems, construction of new water pipelines.

As a result of the construction work implementation, as well as further operation and maintenance of the water supply systems there might be negative impacts on the environment.

---

2 The number of towns and villages may change subject to further detailed assessments.

Package IV.1 Hrazdan towna nd Qaghsi village Environmentantal Management Plan
It is expected that the impacts during construction work implementation will be minimal and temporary. The impacts may involve vegetation cut, soil erosion, air, soil and water resource pollution by lubricants, chlorine compositions as well as household and construction waste.

At the Operation stage the environmental impact, mainly reasoned by improper execution of operation requirements, will decrease.

The improvement activities will be considered environmentally friendly in case of water resource conservation, as well as rational and sustainable use.

The social and economic effect as a result of water supply system improvement are expected to be long-term, mostly positive, excluding potable and waste waters mix, minimization of water pollution risk, prevention and exclusion of infection disease agents penetration into potable water, as well as water supply extension, providing sustainable water supply and rational water use.

The EMP Part 5 introduces description of possible impacts and is facilitating measures required at different stages of realization of Water Supply Systems Improvement Project.

- **Designing stage**

The design works on water systems have been performed by the JV of HGSN and JINJ, selected as a Consultant to provide services for design, construction supervision of civil works and public awareness campaign within the framework of ADB “Water Supply and Sanitation Sector Project – Additional Financing”. The EMP includes articles on climatic conditions, relief, natural soil types, hydrology and biodiversity of the very package, requirements on obtaining the RA MoNP and other Ministries’ agreements, as well as fulfillment of executive parties’ contractual commitment during all stages. The Design documentation includes corresponding environmental and social articles and separate Matrix of this very Subproject. The Project Consultant is in charge to follow the appropriate statements of the RA Environmental and social legislation, as well as ADB instructions and strategy requirements.

- **Construction stage**

The list of measures required to mitigate the environmental impact during construction stage is separately provided in the EMP matrix (APPENDIX A).

The Contractor should strictly follow the requirements on environmental impact mitigation measures, which are involved in the EMP.

- **Operation Stage**

The Operation should be performed in accordance with the Water System Operational Rules and Standards.

4. **SCOPE OF WORKS**

4.1. **Description of existing water supply systems**

4.1.1. **Description of existing water supply system of Hrazdan town**

The water supply of Hrazdan town is performed through, passing town area in the coastal of Hrazdan.
river, located on 1700-1705m elevations Maqravan springs: “Maqravan-2” and “Maqravan-3” pumping stations, which total power forms approximately 1350-1400 l/sec.

Through existing pumping stations located in the area of “Maqravan” springs, except Hrazdan town, currently is also performed water supply of Abovyan and Tsaxkadzor towns.

The number of households in the town is 13200, the number of multi-apartment buildings is 290, and residential houses is 3349.

Calculated average daily water demand of the town for drinking and household purposes forms 22000m³/day (including regulatory permissible 20% leakages).

The length of the water supply network is approximately 300 km.

During 2010-2012 yy in the water supply system of Hrazdan town a number of works have been implemented, especially:

- In 2010-2011 yy by the World Bank financing, a number of works have been implemented in the distribution network of Hrazdan town, which include replacement of water pipelines in the “Southern”, “Jrarat” and “Vanatur” blocks of the town, construction of entry lines and water meter hubs of about 80% personal houses, entry lines replacement in the approximately 30% of multi-apartment buildings of “Kentron” and “Mikro” blocks.
- In 2011-2012 yy by the ADB financing, for the water supply purposes of the town, 2 groups, each of 3 pumping aggregates have been installed in the “Maqravan-2” pumping station.

After the implementation of the above mentioned programs, though decrease in supplied water with approximately 30% and in the conditions of existing 82% leakages in the distribution network, currently the average duration of water supply, forms about 15 hours.

- In the “South” district – 15-20 hours
- In the “Kentron” district - 14 - 16 hours
- In the “Jrarat” and “Vanatur” districts - 15 hour
- In the “Mikro” districts - 9 - 13 hours.

4.1.2. Description of existing water supply system of Qaghsi rural community

Qaghsi rural community is included in Hrazdan district of Kotayk marz. The village has 615 households. Water supply is performed through Maqravan-Abovyan DN700 pumping station fed from main pipeline and passing through village area, which was constructed in 2007.

From the new constructed pumping station water is pumped to the new DRR with the capacity of 300m³, located near Erevan-Sevan highway, which was constructed in 2011-2012yy with the program of ADB financing. In the frame of the latter, the pipeline from pumping station to DRR also was reconstructed with DN100 steel pipes.

During 2011-2012yy in the result of the implementation of these works, water supply internal system of Qaghsi village currently is in normal condition. However because of dilapidated and emergency
conditions of distribution network pipelines, the general water supply of the village is in extremely inconsoable condition, as a result of which the level of leakages reaches 95%.
Currently 2 times a day (with 2-3 hours), located in the village area the old pumping station in ruined condition also is operating, from which 10 l/sec pumped water directly is given to the distribution network. Virtually, in the huge 95% leakage conditions the operation of the latter is purposeless.

4.2. Description of proposed rehabilitation works

In the frame of this very Subproject is designed:
- to reconstruct those parts of distribution network, fed from Hrazdan “Northern” DRR, which due to lack of funds were not included in 2010-2011 World Bank financing program: to reach all day long water supply of distribution network.
- Completely rebuilt the distribution network of Qaghsi village.

For that purpose, it is designed to implement reconstruction works in the “Mikro” and “Kentron” districts, which are constructed with multi-apartment buildings, and in “jrarat” and “Maqravan” districts, which are constructed with personal houses.

The implementation of the Subproject will allow, in the result of water supply systems rehabilitation, to provide the inhabitants of 2 mentioned communities with safe potable water and improve water distribution system.

The permanent population number in Hrazdan town, according to the RA Statistical Service data, on 1 January 2012 makes 10250 in the southern part, 46125 in the northern part, and in Qaghsi village 2454 people. Taking into account the population prospective growth by 2040, assuming 0.43% annual growth, above mentioned communities will have 11558 in the southern part, 52013 in the northern part and 2767 inhabitants in Qaghsi village.

The average hourly discharge of maximal daily water demand of the communities, taking also into account the normative permissible leakages, makes $Q_{av,h}=250l/sec$ for Hrazdan town and $Q_{av,h}=8,2l/sec$ for Qaghsi village.

Based on the technical and economical calculations done in the Preliminary Design, as well as submitted justifications, in the Detailed Design there have been developed activities on the water supply rehabilitation.

By the very Detailed Design the works designed for the improvement of water supply system in Hrazdan town and Qaghsi rural community are as follows:

1. Hrazdan
- Replacement of inter district de100- de225 main pipelines of the distribution network, with general 19.5 km length, with polyethylene pipes,
- Replacement of multi-apartment buildings entry lines connections, with the total number of 115, for which will be constructed approximately 4.3 km de63-de100 polyethylene pipes,
- Replacement of private house entry lines connections, with the total number of 365, for which will be constructed approximately 2.7 km de20-de32 polyethylene pipes,
- Replacement of business entities entry lines connections, with the total number of 284, for which will be constructed approximately 3.4 km de20-de32 polyethylene pipes,

**v. Qaghsi**
- Replacement of inter district de63-de110 main pipelines of the distribution network, with approximately 10.0 km general length, with polyethylene pipes,
- Replacement of private house entry lines connections, with the total number of 295, for which will be constructed approximately 2.8 km de20-de32 polyethylene pipes,

The aggregative indexes of the designed works of 2 communities included in the Subproject are introduced in table below.

According to the agreement between the Contractor, Consultant and rural communities, the mentioned beneath works should be implemented by the construction completion, in spite of the pipeline diameter and its function.

1. To restore the asphalt concrete pavement of roads which were previously in favorable condition, providing the same cover quality,
2. To perform backfilling of the trenches in the destroyed and half-destroyed streets paved with asphalt concrete, then 10-15 cm gravelling with compaction.

<table>
<thead>
<tr>
<th>Works</th>
<th>M/U</th>
<th>t.Hrazdan</th>
<th>v.Qaghsi</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstruction of de100-de225 diameter polyethylene pipeline of water supply internal system</td>
<td>lm</td>
<td>19500</td>
<td>-</td>
<td>19500</td>
</tr>
<tr>
<td>Reconstruction of de163-de100 diameter polyethylene pipeline of water supply internal system</td>
<td>lm</td>
<td>-</td>
<td>10500</td>
<td>10500</td>
</tr>
<tr>
<td>Replacement of private houses connections</td>
<td>lm</td>
<td>2700</td>
<td>2400</td>
<td>5100</td>
</tr>
<tr>
<td>Replacement of connections of apartment buildings</td>
<td>lm</td>
<td>4300</td>
<td>-</td>
<td>4300</td>
</tr>
<tr>
<td>Replacement of business entities connections</td>
<td>lm</td>
<td>1700</td>
<td>-</td>
<td>1700</td>
</tr>
</tbody>
</table>

5. BASELINE ENVIRONMENTAL CONDITIONS

**5.1. Geographic location and climate of settlements**

Kotayq marz is located in the central part of RA, at 900-2500m elevation marks above see level. The area includes upper and middle basins of Hrazdan river and the Marmarik river basin totally.

From the climatic conditions point of view Kotayq Marz is divided into mountainous and high mountainous zones. By uplands alternation, in the marz relays almost all types of Republic area-specific climate.

Hrazdan town and Qaghsi rural communities are situated in Kotayq marz and are allocated on right and left sides of Hrazdan River. Since December 1995y, Hrazdan town became the marzal center of Kotayq. The distance of Hrazdan town from capital Yerevan is 45km. The length of the town makes 22.0km.
Qaghshi rural community is located 3km far from Hrazdan town, at 1700-1750m elevation marks. The Northern border is Tsaxkunianc Mountain range, and from East Gexama Mountain range. Through village are passing Hrazdan-Sevan, Hrazdan-Ashtarak highways, Sevan-Yerevan railroad. The climate of the studied area is characterized by cold winter and mild, cool summer. The air absolute maximal temperature is +33°C. The air absolute minimal temperature is -31°C. The air relative humidity makes 71%. The average annual atmospheric rainfalls reaches 588 mm. The main rainfalls occure in March-June months. In summer the north-eastern and in winter south-western winds dominate. The snow cover maximal thickness of the ten-day period reaches 132.0cm. The ground freezing maximal depth reaches 0.96m. 

Among exogenic phenomena there are storm flows, storm-beaten; rainfall flows, deepening of the gullies, in some parts stone flows, some technogenic phenomena, etc. From geomorphological point of view the area is located in the south-eastern verge of Tsaxkunianc mountain range, which from East part is limited by north-western verge of Gexama mountains, which are formed from low mound ranges and not deep concavities.

### 5.2. Biodiversity

The studied area of marz is located in the upper stream left sided and right sided Valley of Hrazdan River and it adjacent parts. Here the surfaces are uneven; they have Volcanic Plateau typical hill-dam cut relief types, which absolute marks varies between 1700-1780m ranges.

The lands are belonging to mountainous black soils type. The structure of relief and the lithological composition of mountain rocks in the black soil distribution areas are diverse. In the relief formation of these marzs participared volcanic and volcanic sediment rocks: andesite, andesite- basalts, tuffs and atc.

The Geological structure is diverse. There are meeting average quaternary aged basalts and andesite volcanic flows, lower Eocene limestone and sand-stone sediments, also chalk aged limestone and margas, which are coverd with modern delluvial-proluvian, and due to Hrazdan river activities, lake-alluvial formations, with quite different capacities.

From the hydrogeological aspect the area, depending on geological structure and relief, is represented by two different hydrogeological conditions. Middle cemberian and Eocene aged rocks are considered as Repelling zones and only quaternary aged cracked and porous volcanic rocks are considered as good infiltration zone.

From the orographic aspect, the biggest rivers of the studied area are Hrazdan and its right confluent Marmarik, with their numerous temporary and permanent flows. The marz is situated in 8-9 magnitude potential seismicity zone and has 0.3g acceleraration. 

**Flora.** Kotoyq marz has rich and diverse vegetation, it is located on dry mountain heath and wormwood semidesert borderline. From the plant-geographical aspect the area belongs to floristic area of Aparan.

The forests of the marz are mountainous; they have significant soil protective, water protective and climate regulatory meaning, and also are distinguished by their plant species diversity. The studied area is described with quite huge thermal resources and with longevity of vegetation period. The plant cover in the black soils spread marzs is represented mainly with different, wood-grass plants. The position and relief of the marz contributed to the development of rich biodiversity, unique assortment and agro-biodiversity formation. Here are dominating semidesert, mountain heath landscapes with their corresponding plant and animal worlds.

The vegetation of the studied area is the plant symbiosis typical to the treeless parts of Aparan floristic marz. It is represented with the typical, specific to this marz phytocenosis. The flora of Marmarik pool is represented with more then 801 species and subspecies of superior plants,
which are belonging to the 86 families and 360 nations.
In Hrazdan marz the main forest forming tree species are oak, hornbeam and little quantity of pine.
In the forest symbiosis of the marz a great place occupies large-perpage oak, which very well adapts to the local climatic conditions, dute to its high cold resistance.

Here the spread plant symbiosis mainly consists of annual Poaceae: Aegilops cylindrica, Amblyopyrum muticum, Secale Vavilovii, Triticum araraticum, T. Boeoticum, T. Urartu and etc.
There are also meeting various Vascular plants: Achillea millefolium L., Arctium palladini Grossh., Arteisia armeniaca Lam., Arteisia absinthium L., Falcaria vulgaris Bernh., Eryngium billardieri Delar., Inuia auriculata Boiss. Et Bal., Taraxacum officinale Wigg., Tragopogon reticulatus Boiss. Et Huet, Anchusa azurea Mill., Leontodon crispus Vill., Cichorium intybus L., Helichrysum plicatum DC. and etc.
Although in Kotayq Marz also are meeting other rare and endangered species, which are recorded in the RA Red Book (Iris reticulata, Rhizocephalus orientalis, Hohenackeria excapa, Cundelia tournefortii and etc.), however in the vegetation structure of the Subproject there are no rare, endangered and Armenian endemic species.

**Fauna.** From the animal world representatives here are meeting many types of reptiles, from which are Gyrurza, Malpolon monspesscullanus, Mabuya aurata, Eumececs schneideri and etc. From the amphibious are meeting Rana ridibunda, Bufo viridis, Hyla savigna. From birds (about 50 type) are remarkable Coturnix coturnix, Perdix perdix, Streptopelia turtur, Falco tinnunculus, Circus macrourus, Athene noctua, Coracias careulus and etc.
Species of mammals are fox and weasel, deer, rabbit, rarely also marten, bear, wolf and badger.
Within common beetles and butterfly species are recorded also Armenian, Caucasian and Transcaucasia endemic species: Milbaris sedilithorax, Omophlus caucasicus Kirsch, Cicindela desertorum, Ceutorrhinchus bialegiatus Schz., Anisoplia signata Fald., Stenus buftalmus Grav..
Near the Hrazdan town is also meeting Bradyporus dilatatus, which is recorded in the RA Red Book.

### 6. ENVIRONMENTAL AND SOCIAL IMPACTS

Due to the implementation of works aimed at the improvement of water supply systems of Hrazdan town and Qaghsi rural community the expected positive environmental and population health effects are as follows:

- water resource protection and sustainable use,
- excluding mixing of drinking, irrigation and sewerage water,
- preventing, excluding penetration of infectious disease viruses into drinking water,
- reduction of drinking water pollution hazard,
- providing high drinking water quality,
- improvement of health condition of population,
- water loss reduction,
- increasing duration of water supply to population,
- introduction of water metering system,
- increasing water consumption efficiency.

IEE reveals that the implementation of works aimed at water supply systems improvement in Hrazdan town, Qaghsi village of the Kotayq marz will have no harmful effects on the selected for this purpose area – either landscape or flora and fauna.
The probable negative effects might be mainly caused by construction works implementation, with little damage and carrying temporal character. To prevent or mitigate negative impacts there have been developed mitigation measures which are involved into the EMP.

EMP is the integral part of the bidding document and based on the IEE the expected negative impacts are as follows:

- air pollution
- noise
- traffic and pedestrian roads damage and loading
- soil erosion and soil eroding processes
- environment pollution by construction and household waste
- soil and water resources pollution by fuels and lubricants,
- soil and water resources pollution by chlorine.

Subproject implementation will have positive social effects directly improving the targeted communities population life quality providing sustainable and reliable water supply and water resource rational use for about 56000 person.

**7. ENVIRONMENTAL IMPACT MITIGATION MEASURES**

The probable harmful impacts on the environment and people’s health, caused by the works aimed at the W&W internal system improvement of Hrazdan town and Qaghsi village of RA Kotayq Marz, depend on construction works of water pipeline trenches and pits for control and water measuring junc.

To prevent soil erosion and eroding processes the preventive measures should be performed on slopes protection on the inclined areas designed for the pipe laying, providing minimal short time of keeping open the trenches and pits made for the pipelines and control and water measuring junctions.

The slopes protection measures should be performed to prevent soil eroding processes on the areas close to the riverbeds.

After construction work completion the sites should be recovered by performing the mentioned beneath activities:

- Remove the excess soil mass and building material from the construction sites,
- 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 dirt roads.

To prevent the topsoil layer damage, or landscape degradation, the topsoil should be stored on the assigned site, there after used for the areas restoration. The construction site should be cleaned from the household ad construction waste providing the landscape previous state.

To prevent the soil and water resources pollution by fuels and lubricants, the latter should be stored on the area isolated from soil and water resources, in special tanks. Special containers should be prepared for the utilized lubricants, which thereafter will be disposed in landfills orplaces for reprocessing.

To prevent the environment pollution by construction waste and excess soil mass they should be disposed on special sites according to the agreements signed beforehand between community head and disposal site superintendent.
To avoid *water and soil resources pollution* by chlorine, the works on chlorine washing and disinfection should be arranged considering special calculations. Chlorine handling needs treating the appropriate way, following the established technological procedures. After washing the pipes, the chlorine outflow to the surface water unit, or land area, should be controlled according to the designed mode and calculation.

**Water quality change.** While performing the environment monitoring the supervision on water quality and residual chlorine should be arranged.

To minimize *dust emission* caused by construction works the site should be regularly watered.

To prevent noise impact the schedule should be developed on limiting the night works on the residential areas, avoiding noisy vehicles and equipment use, installing mufflers, if necessary.

To minimize the population disturbance caused by roads damage and loading, the special parking lots for trucks should be provided, and the construction works should be performed by stages, arranging population awareness campaign, including provision of special traffic signs, providing bypasses, or barriers.

To provide population and builders’ safety and *prevent risks* during the construction, the unauthorized persons’ entrance to the construction site should be controlled, warning signs should be placed in the accident-prone sectors, regular inspection of equipment by qualified specialists should be performed, including safety audits, first aid and safety courses organization for builders.

The affected parties and local population should be appropriately informed through public consultations on the coming activities, their schedules and all measures involved in the EMP, since information lack can bring forth discontent causing complains. Providing the communities’ participation in the Subproject will minimize the disturbance caused by construction works to the social life of community.

**Potable water quality change:** EMP should involve monitoring of water quality and residual chlorine level.

To provide water quality in Hrazdan town and Qaghsi village the AWSC should perform routine sampling from the springs feeding the communities, testing, the water for all criteria required by MoH. Water quality monitoring is also performed by the State Hygiene Anti-Epidemic Inspectorate according to the document “Potable water. Requirements on water quality of centralized water supply systems. Sanitation rules and norms of quality inspection № 2-III-A2-1” (recorded on 28.12.2002), which specifies the potable water quality requirements, including the rules of quality inspection of water produced and supplied through water distribution systems to the residential areas.

Since water disinfection is performed by chlorine, the monitoring of residual chlorine level is also of great importance.

**8. INSTITUTIONAL FRAMEWORK OF ENVIRONMENTAL MANAGEMENT**

To perform the proposed mitigation measures, the obligations on their arrangement have been allocated between the agencies, as follows:

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

  1. To perform this special task the implementing unit (JV of HGSN and JINJ) in the Designing stage should provide the obtaining of all required agreements and permissions from the corresponding public administrative and local self-governing bodies before civil works distribution according to the bidding terms.

     - Environmental expertise (if necessary).
     - Consent of Protection Agency of Historical and Cultural Heritage, in case of expected impact on the latter.
2. The implementing agencies in the construction stage (Contractors) will covenant to physically implement the specified in the EMP facilitating measures, as well as obtain all permissions and consents relating to the civil works implementation, which are as follows:

- local municipal bodies’ written consents on the specified sites for household and construction waste disposal,
- Consent of Historical and Cultural Heritage Protection Agency, in case of historical, cultural or ancient monuments occurrence during civil works implementation.

3. Before civil works startup the mentioned beneath permissions and certificates should be obtained by ADB/PMU, if necessary:

- Certificate on land use right registration
- Water use permission, if necessary.

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

1. The environment and safety specialists of “AWSC” CJSC/ADB PIU will be responsible to supervise the implementation of mitigation measures specified in EMP. The mentioned experts will regularly perform site visits to supervise the proper implementation of works and corresponding activities on mitigating the impacts. During the visits the probable omissions will be revealed by the check list, as well as violations of mitigation measures implementation by Contractors.

“AWSC” CJSC /ADB PIU is also entitled to require and checkup the availability and validity of all permissions, complete implementation of mitigation measures and monitoring according to the EMP in terms of ADB environmental instructions and the RA nature protection and social legislation.

2. The JV of HGSN and JINJ are also to carry out the supervision over the implementation of mitigating measures during civil works implementation. The environmental specialist of the Consultant should make visits to control the implementation of EMP.

   • **State monitoring agencies, which are responsible for observing the extent and efficiency of EMP implementation and mitigation measures, and making corrections in the project, if needed.**

The state monitoring agencies are as follows:

- State Environmental Inspectorate of the RA MoNP,
- State Hygiene and Anti-Epidemic Inspectorate of the RA MoH,
- Historical and Cultural Heritage Protection Agency of the RA MoC, if necessary,
- The RA local self-governance bodies,
- The RA MT&C.

Costs 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 followed payment will be terminated until the infringement is completely eliminated.

**9. ENVIRONMENTAL MANAGEMENT PLAN**

The EMP will be based on the results of IEE developed by the subproject and will include appropriate
mitigation measures.

EMP 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 EMP. The costs foreseen for the implementations of all the measures prescribed in the EMP are included the total cost of the Contract and reflected in the bill of quantities.

- Notice on the failure to implement measures prescribed by the Technical Supervision Company (TSC) or the Client would be sent to the Contractor as precaution.
- After one precaution the next recorded violation would trigger charging of liquidated damages in amount of 0.1% of the total cost of the contract. The penalties do not relieve the Contractor from remedying the violation. The recorded violation should be remedied in two working days period. Penalty fees would be retained from the next Performance Certificate and after the completion of the construction activities the liquidated damages for the recorded violation will be retained from the guarantee amount.
- In case of three liquidated damages the Contract could be terminated unilaterally.

The environmental management matrix for Hrazdan town and Qaghsi village is presented in Appendix A.
### ENVIRONMENTAL MANAGEMENT MATRIX

<table>
<thead>
<tr>
<th>Works and possible impacts</th>
<th>Proposed mitigating measures</th>
<th>Monitoring</th>
<th>Responsible bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Air pollution, noise and traffic congestion</strong></td>
<td></td>
<td>Daily site inspection</td>
<td>Contractor, Consultant, PIU</td>
</tr>
</tbody>
</table>
| Dust and noise during the construction works | - Install fencing around construction site  
- Regularly water the construction site and roads  
- Limit night work in residential areas  
- Avoid usage of machines/equipment with extra noise; installation of silencers if needed. | | |
| Disturbance to population because of overloaded roads | - Provide safe area for trucks,  
- Do not accumulate and burn waste on the construction site.  
- Carry out construction in stages; give adequate notice of construction activities to the population.  
- Provide effective road signs, bypasses or barriers; provide areas for parking.  
- Provide community participation in subproject works, which will minimize disruption to community social activities. | Daily site inspection | Contractor, Consultant, PIU, LSGB |
| **2. Environmental pollution** | | | |
| Soil erosion | - In inclined sites of the pipeline route implement measures for retaining the inclinations to prevent soil erosion and sand spreading.  
- Minimize the time during which trench and pit excavations for pipelines, regulation and water metering junctions are open. | Daily inspection of construction and contract tecservices stages | Constructor, Consultant, PIU |
| Damage to soil fertile layer or landscape degradation | - To store soil fertile layer in the specially provided areas and to use them in future with area restoration purposes.  
- To clean, to level the area after completion of construction works, and to bring the landscape to its original view. | | Contractor, Consultant, PIU, LSGB |
| Environment pollution with construction waste | - Remove construction waste to corresponding landfill of the community, having in advance a contract agreement with the community heads or landfill operators.  
- Rehabilitate disturbed surfaces as soon as possible after completion of construction activity, according to the design. | Inspection of measures required after implementation of construction works | Contractor, Consultant, PIU, LSGB |
| Land and water resources pollution with fuels and lubricants | - Store oil, fuels and lubricants on a sealed surface, away from land water resources. 
- For collection of used oil special containers furnished with leakage collecting system to be provided. | Daily inspection of construction site. | Contractor, Consultant, PIU |
| Land and water resources pollution with chlorine | - Organize works for washing the water supply distribution network with chlorine, according to calculations and technological terms. 
- Implementation of chlorine discharge to surface water body or land area after washing the pipes, according to the established regulation and calculations. | Inspection of measures required after implementation of construction works. | Contractor, Consultant, PIU |

### 3. Health and Safety

| Hazards for workers and the population | - Fence the 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. | Daily inspection throughout construction stage. 
- Monthly inspection of accident reports and complaints register. | Contractor, Consultant, PIU, population |
## Field visits checklist

<table>
<thead>
<tr>
<th>General information</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Name of the settlement</td>
<td></td>
</tr>
<tr>
<td>Hrazdan and Qaghsi village</td>
<td></td>
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<tr>
<td>Environmental Management Plan</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Design</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Name of the subproject</td>
<td></td>
</tr>
<tr>
<td>EEC</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Written consent on land acquisition</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Assessment of impact on cultural heritage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Construction</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Name of the subproject</td>
<td></td>
</tr>
<tr>
<td>Written consent on disposal of construction waste</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Written consent in case of sudden discovery of cultural heritage</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Public awareness</th>
<th></th>
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<tbody>
<tr>
<td>Name of the subproject</td>
<td></td>
</tr>
<tr>
<td>Awareness of population regarding construction works according to the project design</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Element</td>
<td>Yes</td>
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<tr>
<td>------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Participation of community in construction works according to the project design</td>
<td>Yes</td>
</tr>
<tr>
<td>Safety</td>
<td>Yes</td>
</tr>
<tr>
<td>Availability of safety uniforms (earflaps, mask)</td>
<td>Yes</td>
</tr>
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<td>Yes</td>
</tr>
<tr>
<td>Management measures during construction</td>
<td>Yes</td>
</tr>
<tr>
<td>Operation on area/construction site</td>
<td>Yes</td>
</tr>
<tr>
<td>Availability of storage for oils and lubricants at the appropriate part of the construction site</td>
<td>Yes</td>
</tr>
<tr>
<td>Temporary air pollution/dust</td>
<td>Yes</td>
</tr>
<tr>
<td>Issue</td>
<td>Action</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
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<tr>
<td>Use of cover for the vehicle transporting construction waste</td>
<td></td>
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<tr>
<td>Moisturing the construction site by water</td>
<td></td>
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<tr>
<td>Timely coverage of holes by soil</td>
<td></td>
</tr>
<tr>
<td>Repair of damaged surface after completion of construction works</td>
<td></td>
</tr>
<tr>
<td>Water pollution caused by fuel and lubricants</td>
<td></td>
</tr>
<tr>
<td>Leakage of chlorine after wash up of the pipes according to the scheduled regime</td>
<td></td>
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<tr>
<td>Noise close to settlements</td>
<td></td>
</tr>
<tr>
<td>Implementation of the works during working hours, otherwise in projected manner</td>
<td></td>
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<tr>
<td>Construction waste disposal</td>
<td></td>
</tr>
<tr>
<td><strong>Transportation and disposal of construction and consumer waste in appropriate community landfill</strong></td>
<td>Yes</td>
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</tbody>
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<thead>
<tr>
<th><strong>Drinking water pollution</strong></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
</table>

*Operation*

Correspondence of balance quantity of residual chlorine to the quality of potable water

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*Yes*

*No*

*N/A*