

Armenian Small Municipalities Water Project Engineering, Design and Contracts Supervision

Proj. No. 610-1182



Detailed Design Volume III: Environment Management Plan

REHABILITATION OF WATER SUPPLY NETWORK IN AKHTAL

**Armenian Small Municipalities Water Project
Engineering, Design and Contracts Supervision**

Detailed Design – Volume III: Environmental Management Plan

AKHTALA

FWT / JRTUC - Project No. 610-1182

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Structure of Detailed Design

Volume I	Detailed Design Report
Volume II	Detailed Design Drawings
Volume III	Environmental Management Plan
Volume IV	Detailed Design Cost Calculation

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Abbreviations

ASMWP	Armenian Small Municipalities Water Project
AWSC	Armenian Water Sewerage Company
Bank	European Bank for Reconstruction and Development
Client	Armenian Water Sewerage Company
CNR	Construction norm
Consultant	Fichtner Water & Transportation GmbH in association with Jrtuc LLC
DRR	Daily Regulation Reservoir
EBRD	European Bank for Research and Development
EN	European norm
FWT	Fichtner Water & Transportation GmbH
mg/l	milligram per litre
mg*eq/l	milligram equivalent per litre
WWTP	Waste Water Treatment Plant
LCGA	Local self-governance agency

Bibliography

- [1] COWI, Armenia: Small Municipalities Water – Due Diligence, 2010

1. GENERAL

The planned works will be executed taking into consideration all the environmental policy of the Bank and the environmental requirements and norms stated by Armenian legislation.

In order to prevent negative environmental and social impact during the works, Environment and Safety Management Plan (EMP) and a corresponding Monitoring Plan were developed for the planned works, which are both presented in this chapter.

The population was informed about all the rehabilitation activities through regular meetings, discussions and with the assistance of municipal officials.

2. PROJECT DESCRIPTION

2.1 General description of water supply and sewage system of the project implementation area

Present population of the town of Akhtala is 2400 inhabitants. The population of Akhtala for the planning horizon 2032 forecasted to be also 2400 inhabitants. The calculated present per capita water consumption is 34.7 lcd, and in the future – 120 lcd. Based on the calculations, future water consumption will be 7.7 l/s.

The existing water supply system consists of the following main components:

- Springs -“Lori Berd” (32 captures, 200-260 l/s discharge, “Upper Akhtala” group of captures – 3.5 l/s).
- Water treatment - “Lori Berd”, the chlorination is implemented near the village Aghesi, one ALLDOS is installed, “Upper Akhtala” – the chlorination is implemented in the building locating in the northern head of the city.
- Transmission mains - DN150mm, 825m steel pipes, beginning from “Lori Berd” water main and steel pipeline DN80mm 1.5km.
- Reservoirs – 6 operating DRRs, 785m³.
- Pumping stations – “Upper Akhtala” locating in the northern part of the city.
- Distribution network – 6.2km, DN50-200 steel and cast iron pipes are under operation.

Water supply isn't round-the-clock, most of the population is supplied water by hourly bases. Connection to network is 100%. Water losses in the water supply system make up 89%.

There is a separate sewage collector system. Connection to network is 85%. There is a separate storm water drainage system. The storm water is removed by close network and open flumes. There is no treatment plant for waste water. Wastewater is removed into Debet River or nearby canyons. The removal of solid waste is organized by the local government. The landfill is located at a distance of 5 km.

2.2 Proposed main works of the project implementation area

According to the conducted investigations and calculations a complete list of proposals was prepared for improving water supply system of Akhtala. The main activities are as follows:

- Transmission mains - construction of pipelines in 3460m length;
- Reservoirs – construction of a new 500m³ reservoir and renovation of the cover of DRR V=500m³, reconstruction of valve unit.
- Distribution network - rehabilitation of distribution network 9km.

The main parameters of rehabilitation works are presented in the table 2-1.

Tabl. 2-1: Main parameters of rehabilitation works.

Elements to be improved	Capacity l/s	Diameter mm	Length km	Volume m ³
Transmission mains	9.3	-	3.9	-
Reservoirs	-	-	-	500
Distribution network	-	OD32-OD160	6.9	-

In a result of rehabilitation of the network, water losses will decline and make up 30%.

3. DESCRIPTION OF BASELINE ENVIRONMENTAL CONDITIONS

The town of Akhtala is located on the base of Lalvar mountain on the slope, in the left bank of River Debed at the elevation of 740 m.a.s.l. The town occupies 4.3 km² and has 2 400 inhabitants. It is 10 km far from the town of Alaverdi, 62 km far from the provincial center Vanadzor and 186 km far from the capital Yerevan.

The ancient settlement of Akhtala is located near the current Akhtala town. The area of the ancient settlement includes also Akhtala Monastery. One of the historic monuments around the town is the famous fortress of the 10th century (currently half-destroyed), Apostolic Church and twin churches located west to the fortress (Saint Trinity Church and Mother of God Church, which also is called the Mariam Anna Monastery). In Medieval years it was a Manuscript centre.

There are copper, lead, silver mines in the around the town, which are under operation have industrial meaning.

The economy of the town is specialized in mining industry. The main enterprise of the town is the mining plant for enrichment of polymetallic ore. There are also food industry plants: bakeries, dairy product factories.

Akhtala is located within the "warm" climate zone. The winter is moderately mild and long, warm and relatively humid summer. Average air temperature is 12.3 °C, absolute minimal air temperature is -22°C, absolute maximal air temperature is +30°C. Average annual precipitation is 431mm, maximal 10-day thickness of snow cover is 18cm, soil frost depth – 40cm. No stable snow cover is developed in Akhtala and adjoining areas.

The area of Akhtala township community is located in the upstream basin of Debed River. The length of River Debed is 152km, the reiver network density coefficient is 0.88km/km², main streams are Dzoraget and Pambal.

Based on the chemical composition, surface water of the area belongs to hydro-carbonated group. The surface waters are specified by light mineralization – 100-200 mg/l, light hardness (content of Ca²⁺+Mg²⁺ ions makes up 1.5 -3.0mg*eq/l) and high aggressiveness (the content of HCO₃⁻ exceeds 2.0 mg*eq/l).

The mudflow activity is low, and the probability of mudflows does not exceed 1 in ten years. Debed River is fed by snowmelt (25%), rainfall (31%) and groundwater (44%). The flood period starts in the end of March and continues until end of June. The flow factor is 0.41. Fresh groundwater resources are used for water supply purposes.

The flora refers mainly to greenwood species with occurrence of oriental beech (*Fagus orientalis Lipsky*), oak (*Quercus iberica Stev.*), hornbeam (*Carpinus betulus L.*), oriental hornbeam (*C. orientalis Mill.*) and others.

The soil resources of the area refer to brown forest carbonate type. Humus content in the 0-20 cm soil layer makes up 4-6%. The lands refer to Category V according to erosion intensity (45-70%). The average content of rock particles in soil makes up 10-30%.

About 15% of land fund of the community is occupied by populated areas and homestead plots. 63% is the reserve land fund, 23% - lands of state importance, which have also agricultural importance and are used as plough land (17%) and pastures (41%). Population is engaged mainly in fruit and vegetable growing, livestock farming and poultry farming. The flora is represented by re-production of domestic animals and poultry.

4. POSITIVE AND NEGATIVE ENVIRONMENTAL AND SOCIAL IMPACTS

The activities for improvement of water supply system of Akhtala will have essential positive environmental and social impacts.

Positive impacts are:

- Reduction of water losses,
- Increase of the usage of water resources efficiently due to the implementation of water measure system
- Protection of water resources from inefficient usage,
- Sustainable water supply
- Increase of water supply duration
- Provision of appropriate quality of drinking water
- Reduction of drinking water contamination
- Prevention and elimination of penetration of infections in drinking water
- Improvement of health condition of residents.

Rehabilitation of the water distribution network will result in satisfying population's water demand and in eliminating high water losses. Thus the water resources will be used more efficiently and economically.

By-passing of the cemetery area will sharply reduce population risks to diseases and solve health problems. Improvement of the distribution network will assist in improving the livelihood and social condition of the town's population.

During implementation of works it is intended to prepare the mitigation measures in order to prevent or mitigate the possible negative impacts.

The initial evaluation showed that no irrevocable negative impact is expected in the residential areas of the improvement of water supply system.

The possible negative impacts are related to construction works, therefore they are limited and short. Under the project scope the Environmental Management Plan has been developed (see Annex 1), where the activities for mitigation or preventing the negative impacts are projected.

The following negative environmental and social impacts may occur during rehabilitation of Akhtala's water supply and wastewater systems:

- Air pollution
- Noise
- Soil erosion and landslide processes
- Pollution of the environment by construction waste and garbage
- Contamination of soil and water resources by fuel and lubricants
- Contamination of soil and water resources with chloride.

The description of possible negative environmental and social impacts during implementation of works and their prevention and/or mitigation measures are presented in the following chapters.

5. ENVIRONMENT AND SOCIAL IMPACT MITIGATION MEASURES

The following preventive and mitigation measures have to be implemented in order to mitigate negative environmental and social impacts:

1. Prior to commencement of water supply system's rehabilitation works relevant permits and agreements shall be obtained from local authorities, in particular for disposal of excessive soil and construction wastes in special locations. If wastes contain high rate of harmful components, the appropriate passport of the Ministry of Nature Protection of the RA shall be obtained for their removal and location.
2. The location of access roads, construction sites, vehicles and heavy equipment parking stations, warehouses for construction materials and equipment, warehouses or accumulation sites for storage of dismantled pipes, units, liquid wastes and others shall be determined in advance and be organized in a manner not harming the environment. In particular, where possible the construction site shall be fenced by plastic material. The parking sites for vehicles and heavy equipment, the warehouses and the sites of preliminary accumulation (if relevant) of construction materials and dismantled equipment, liquid wastes and others shall be clearly delimited from the surroundings. The leakage of fuel/lubricants, spreading of wastes or their storage in arbitrary places shall be excluded. After completion of rehabilitation activities those warehouses and accumulation sites shall be completely eliminated and the original appearance of the area be restored.
3. The demolished asphalt has to be adequately collected placed in the special places allocated for the construction waste.
4. Special tanks shall be prepared for collection and storage of liquid wastes. Leakage of liquid wastes into the environment shall not be allowed. The liquid wastes shall be reused or removed according to procedures specified by the Armenian legislation.
5. At the beginning of construction works the fertile soil layer shall be removed and stored and used after construction works for restoring the original appearance of the area (recultivation). While restoring the original appearance of the site, plants typical for the landscape shall be used.
6. Only trucks and construction machines in good technical state shall be used as their emission is within the permissive standards.
7. Use closed/covered trucks for transportation of dusting construction materials and wastes. Regularly water construction sites to reduce dust. Construction sites shall be washed periodically in order to prevent the spread of dust
8. As the construction works will be implemented within inhabited areas, maximally new and good machinery shall be used to reduce noise and vibration as much as possible. The working hours shall be agreed with local authoritative body to disturb them as little as possible.
9. The garbage shall not be stored or removed to places not allocated for that purpose in order not to damage flora and fauna. It is prohibited to use and store very explosive and poisonous

substances. It is prohibited to park, wash, repair vehicles and heavy construction equipment in places not allocated for that purpose. It is prohibited to collect or destroy plants including cutting shrub and trees.

10. The labor shall be ensured with adequate working clothes and personal protecting equipment, in particular with helmets, gloves and others.
11. If historical and cultural monuments and artifacts are found during construction works, the works shall be ceased immediately and the appropriate agency of Ministry of Culture of the RA be informed.

The Environment Management Matrix is presented in Annex 1.

6. ENVIRONMENTAL MANAGEMENT

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

6.1 Agencies responsible for obtaining permits for project implementation

At the design stage, prior to commencement of works, the **Consultant** (JV Fichtner Water & Transportation GmbH/ Jrtuc LLC) has obtained the required agreements, consents and permits from the State and local authorities, including:

- written consent from the local governing authorities for the sites allotted for transportation of excessive soil and construction wastes.

Upon commencement of construction works, **AWS CJSC** shall obtain the following permits and certifications:

- written consent for crossing the infrastructures/communications (gas pipes, electric and telecommunication cable, water pipes) from utility operators;
- construction permits;
- architectural and planning assignments.

Contractors (responsible for construction works implementation, to be selected through tendering) will be responsible for physical implementation of mitigating measures planned under the EMP and for obtaining any additional permissions/consents if a need for such documents emerges during construction. This includes, but may not be limited to obtaining of:

- permission from the State Agency for Protection of Historical and Cultural Monuments in case of encountering chance finds in the course of earth works.

6.2 Supervising agencies responsible for controlling implementation of the EMP measures

- The **Consultant** (JV Fichtner Water & Transportation GmbH/ Jrtuc LLC) will provide technical supervision of the construction works, including environmental and safety supervision. Technical supervisors will implement control of in time, due and reliable implementation of mitigating measures during the construction, prepare regular reports (quarterly) and submit to the Client.
- Environmental and Social Impact Specialist of AWSC will be responsible for timely, due and reliable implementation of the works and measures provided under the EMP. The Environment and Safety Specialist of the Consultant and the Environmental and Social Impact Specialist of AWSC will regularly visit the construction sites to supervise due implementation of the measures aimed at mitigation of work impact. During the visits the possi-

ble shortcomings and omissions will be identified in implementation of mitigating measures and infringement by the Contractor during construction will be discovered. AWSC's environmental and social impact specialist oversees performance of the Technical Supervision Company from the environmental perspectives. For provision of quality assurance of environmental works, TSC should present quarterly reports to the AWSC's environmental and social impact specialist.

6.3 State monitoring agencies responsible for controlling EMP implementation efficiency

- State Environmental Inspectorate of RA Ministry of Nature Protection,
- State Hygiene and Anti-Epidemiological Inspectorate
- The State Agency for Protection of Historical and Cultural Monuments, if needed,
- The RA local governance bodies,
- The RA Ministry of Transport and Communication, if needed.

7. SUBMISSION OF REPORTS

Taking into account the launching period for rendering the services, the Consultant will submit Quarterly Progress Reports by the fifteenth day of the following quarter.

The report shall be submitted in Armenian and English and will include description part (quarterly progress on environmental and social), photos and environmental mitigation measures monitoring table.

8. ENVIRONMENT MANAGEMENT PLAN

The EMP has been developed based on the results of environmental screening under the investment program and includes appropriate mitigation measures.

EMP consists of two components:

- **Mitigation measures and agencies responsibilities for implementation;**

The **Contractor** shall 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 value of the Contract and reflected in the bill of quantities.

- **Environmental monitoring.** On a quarterly basis Consultant should update information on monitoring of environmental mitigation measures and incorporate that table in quarterly report (during construction).

Notice on the failure to implement measures prescribed by the **Consultant** or the **Client** would be sent to the **Contractor** in written. After the Notice to Correct, the next recorded violation would trigger charging of liquidated damages in the amount of 0,1% of the total value of the contract. The liquidated damages do not relieve the **Contractor** from remedying the violation. The recorded violation should be remedied in two working days period. Liquidated damages 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 Retention Money. In case of three liquidated damages the Contract may be terminated unilaterally.

The above described paragraphs of EMP violation will be included in the Contract for provision of works concluded by AWSC under the Project.

9. ANNEXES

Annex 1: Environmental management matrix

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<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
Disruption of the natural and urban landscapes and loss of biodiversity	Selection of routes of water mains and internal network taking into account engineering-geological conditions of the area, minimizing the adverse impact on natural and urban landscapes.	Presence of instructions in design documents	Review of design documents	Upon delivery of draft design documents	Consultant	AWSC, LSGB
	Instructions provided for washing and disinfecting the water main and the network with chlorine, with reference to formal guidelines.					
Activation of land erosion and landslide process	Selection of routes of water mains taking into account engineering-geological conditions of the area	Sensitivity of design to geological conditions of the project site	Review of design documents	Upon delivery of draft design documents	Consultant	AWSC LSGB
Construction and household wastes (garbage) accumulation and transportation	On-site collection of waste in the designated locations and timely out-transportation to the destinations of final disposal	Construction sites free of litter and scattered construction waste	Site inspection	During construction works	Contractor	TSC, AWSC
	Obtaining written consent for disposal of construction waste from local self-governing bodies	Presence of waste disposal permission	Inspection of documents at Contractor's office	Before commencement of construction works	Contractor	

<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
	Waste disposal to the formally designated locations	Absence of large volumes of the household and construction waste at the construction site Absence of waste on site upon completion of construction	Field visit	During construction Prior to hand over of the completed works	Contractor	TSC, AWSC
Generation of dust	Dust emission from transportation of construction materials	Use of closed/covered vehicles for transportation of powdery construction materials	Field visit	During construction	Contractor	TSC, AWSC
	Regular watering of construction sites in populated areas	No excessively dusty conditions on-site	Field visit	During construction	Contractor	TSC, AWSC
Contamination of soil and water with fuel and lubricants	Storage and application of fuel/lubricants in the conditions excluding spillage and leakage	Area allocated for storage and application of fuel/lubricants insulated and confined No fuel and/or lubricant spills observed on-site	Field visit	During construction	Contractor	TSC, AWSC
	On-site storage and storage and safe disposal of used lubricants and their removal to designated disposal sites or recycling facilities	Presence of containers for storing used lubricants Presence of formal arrangements for disposal or hand over of used lubricants	Field visit, Inspection of documents	During construction	Contractor	TSC, AWSC

<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
Noise and vibration	Limiting of construction works to working	No excessive noise out of working hours No complaints from affected communities	Field visit, Consultation with affected communities	During construction	Contractor	TSC, AWSC
	Technical condition of construction vehicles and machinery	Absence of excessive noise from engines No complaints from affected communities	Field visit	During construction	Contractor	TSC, AWSC
Safety of pedestrians and traffic in and around construction sites	Installation of appropriate road signs and provision of temporary by-pass arrangements as required	No disruption of traffic and no constraint for pedestrian access	Field visit, Consultation with affected households	During construction	Contractor	TSC, AWSC
Impact on archaeological monuments	Immediate termination of earth works in case of chance finds and prompt communication to the Agency of Protecting Cultural Heritage	No damaged archaeological items	Field visit	During construction	Contractor	TSC, AWSC RA MC
Landscape degradation and soil erosion	Separate storage of top soil and its restoration upon completion of construction works	Top soil stored in separate piles Top soil re-deposited over the construction site	Field visit	During construction	Contractor	TSC, AWSC
	Timely backfilling of excavated trenches	No trenches left open for excessive periods of time	Field visit	During construction	Contractor	TSC, AWSC

<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
	Installation of gabions for laying pipelines in the sloped terrain	Presence of gabions	Field visit	During construction	Contractor	TSC, AWSC
	Harmonization of construction sites with landscape promptly upon completion of works	Construction site restored to quasi-original condition to the permissible extent	Field visit	Prior to hand over of constructed infrastructure	Contractor	TSC, AWSC
Environment pollution with chlorine use for disinfection of newly constructed pipelines	Prevention of release active and highly concentrated disinfectants to nature	Deactivation and delusion of chlorine prior to release of disinfectant to nature	Field visit	During disinfection of pipelines	Contractor	TSC, AWSC
Workers' exposure to dust and noise	Provision of protective gear (masks, ear phones) to workers for the use industry and noisy environment	Workers equipped with and wearing protective gear	Field visit	During construction	Contractor	TSC, AWSC
Maintenance of work site and work camp (if existing)	Provision of water, sanitation, and household waste containers on work site	Satisfactory sanitary conditions	Field visit	During construction	Contractor	TSC, AWSC
Safety of construction machinery	Standard technical condition of construction machinery formally certified	Presence of positive expertise reports for operating cranes and other machinery deployed at the construction site	Inspection of documents at Contractor's office	During Construction	Contractor	TSC, AWSC

<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
Conduct of excavation works	Demarcation of open trenches and other dig-outs	Open trenches and other dig-outs demarcated	Field visit	During Construction	Contractor	TSC, AWSC
Conduct of earth works in sites with asbestos pipes currently in operation	Accurately demarcate location of asbestos pipes and excavate cautiously along the marked area to avoid contact with existing pipes. In case of unintended unearthing of asbestos pipes, immediately backfill the dug-out area, compact soil, and place warning signs.	Respectively marked asbestos pipe location	Field visit	During Construction	Contractor	TSC, AWSC
Preparedness for accidents at work site	Provision of the first aid medical kits and fire-fighting equipment	The first aid kits and fire-fighting equipment present on site	Field visit	During Construction	Contractor	TSC, AWSC
Safety of staff involved in chlorination processes ¹	Continuous control of chlorination stations Training of operators (conducted by HTH tablets providers) Provision of protection and	No health damage of operators of chlorination stations incurred from exposure to chemicals	Visit to chlorination stations	During operation of the water supply system	AWSC	SCWM

¹ RA Government Decree N-529Ն dated April 21, 2011 on "Approval of safety rules during production, use, storage and transportation of chlorine".

<i>Expected Impact</i>	<i>Mitigation measures</i>	<i>Monitoring indicator</i>	<i>Monitoring method</i>	<i>Monitoring duration</i>	<i>Executing agency</i>	<i>Supervising agency</i>
	emergency response equipment for operators					
Soil and water contamination by water treatment sludge (river, well, spring catchments)	Sludge disposal strictly at the sites formally designated according RA legislation	Sludge safely disposal at approved sites	Visit to treatment station, observation	During operation of water supply system	AWSC	SCWM
Pollution of water sources from domestic sources and domestic animals	Protection of sanitary zones from trespassing	Sanitary zones secure and clean	Visits to sanitary zones	During operation of water supply system	AWSC	SCWM