

**STATE COMMITTEE ON WATER SYSTEMS
THE REPUBLIC OF ARMENIA**

**THE STUDY
FOR
IMPROVEMENT OF RURAL WATER SUPPLY
AND
SEWAGE SYSTEMS
IN
THE REPUBLIC OF ARMENIA**

FINAL REPORT

DATA BOOK (3/4)

MARCH 2009

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

THE STUDY
FOR
IMPROVEMENT OF RURAL WATER SUPPLY AND SEWAGE SYSTEMS
IN
THE REPUBLIC OF ARMENIA

FINAL REPORT
DATA BOOK (3/4)

3. GAGHARKUNIK MARZ

- 3.1 Water Resources Survey and Water Quality Analysis Results
- 3.2 Inventory of Existing Water Supply Facilities
- 3.3 Results of Socio-economic Survey
- 3.4 Existing Water Supply Facilities Map
- 3.5 Preliminary Design
- 3.6 Water Supply Rehabilitation and Improvement Plan Map
- 3.7 Cost Estimate
- 3.8 Financial Analysis

No.	Rural Community	No.	Rural Community
1	Akunq	26	Tsovinar
2	Aghberq	27	Kalavan
3	Aygut	28	Barepat
4	Ayrq	29	Karchaghbyur
5	Antaramej	30	Dzoragyugh
6	Astghadzor	31	Dzoravanq
7	Artsvanist	32	Madina
8	Geghamabak	33	Maqenis
9	Geghamavan	34	Mets Masrik
10	Gegharkunik	35	Norakert
11	Geghhovit	36	Shatjreq
12	Ddmashen	37	Shatvan
13	Dprabak	38	Shorzha
14	Drakhtik	39	Jaghatzadzor
15	Yeranos	40	Semyonovka
16	Zolaqar	41	Vaghashen
17	Zovaber	42	Vardadzor
18	Tazagyugh	43	Verin Getashen
19	Lchavan	44	Torfavan
20	Lusakunq	45	Poqr Masrik
21	Khachaghbyur		
22	Tsaghkashen		
23	Tsaghkunq		
24	Tsovagyugh		
25	Tsovak		

3 GEGHARKUNIK MARZ

No.1 Akunq

Information on Existing Water Sources (Gegharkunik)

Study for Improvement of
Rural Water Supply and
Sewage Systems in RA

No.1 Community Akunq
District Vardenis
Marz Gegharkunik

No	Water source	Latitude			Longitude			Atitude	Yeild(L/sec)		
		deg	min	sec	deg	min	sec	(m)	Min	Max	At site
1	Spring	40	9	20.0	45	43	43.9	1,961	15.0	15.0	15.0
2											
3											
4											
5											
6											
7											
8											
9											
10											
Notes:											
Latitude, Longitude, Atitude:		Measured at site									
Yield (Min, Max):		Interviewed to the Community									
Yield (at site):		Measured / estimated at site in summer of 2007									

Users Acceptnce for water quality	Acceptable
Notes	Water amount from "Akunq" springs is 2200l/sec. Water volume is sufficient enough.
Alternative sources if any	Other sources are not needed.

No.1 Community Akunq
District Vardenis
Marz Gegharkunik
Sampling date 18/Aug/2007

	Parameters analysed	Units					Guidelines	
							WHO	Armenia
a	pH		8.2				6.5-8	6.0 - 9.0
b	Temperature	Deg.C	6.9					
c	TDS	Mg/L	54				1000	1000
1	Al:Aluminum	Mg/L	n.d.				0.10	0.50
2	B:Boron	Mg/L	n.d.				0.70	0.50
3	Cl:Chloride	Mg/L	6				250	350
4	Cr:Chrome	Mg/L	<0.01				0.05	0.05
5	Cu:Copper	Mg/L	n.d.				2	1
6	F:Fluoride	Mg/L	0.05				1.50	
7	Hardness	Mg/L	94				500	700
8	Fe:Iron	Mg/L	n.d.				0.30	0.30
9	Mn:Manganese	Mg/L	n.d.				0.40	0.10
10	Mo:Molibdenum	Mg/L	<0.02				0.070	0.250
11	Ni:Nickel	Mg/L	<0.006				0.020	0.100
12	Nitrate(NO3+)	Mg/L	2.7				50.0	45.0
13	SO4:Sulfate	Mg/L	2.0				250.0	500.0
14	Zn:Zink	Mg/L	n.d.				3.0	5.0
15	As:Arsenic	Mg/L	n.d.				0.0	0.1
16	Ba:Barium	Mg/L	<0.01				0.70	0.10
17	Be:Berillium	Mg/L	n.d.				NA	0.00020
18	Cd:Cadmium	Mg/L	0.0002				0.0030	0.0010
19	Pb:Lead	Mg/L	<0.001				0.010	0.030
20	Hg:Mercury	Mg/L	n.d.				0.00100	0.00050
21	Se:Selenium	Mg/L	n.d.				0.010	0.010
22	Sr:Strontium	Mg/L	n.d.				NA	7.0
23	CN:Cyanide	Mg/L	n.d.				0.070	0.035
24	Coli form bacteria	bacteria per 100 ml					-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml					0	0
26	Total bacteria	bacteria per 1 ml					-	50

Information on Existing Water Sources

Existing Bacteriological Test

Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.1	Community	Akunq
	District	Vardenis
	Marz	Gegharkunik

[illegible]

No. 1 Marz Gegharkunik Community Akunq**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Fair	Possible	
2	Transmission pipeline	Possible	Possible	Pipeline is generally along or close to the road
3	Reservoir	Possible	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°09'20.0"	45°43'43.9"	1,961	1965	Concrete	15.0	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	200	150	Steel	15	1964	Medium	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°09'17.0"	45°43'47.8"	1,998	Concrete	Circle	D=5, H=5	400	Yes

5. CHLORINATION EQUIPMENT

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	Yes	Intake	Powder	Daily

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	8,500	150	Steel	1964	Huge	Yes
2	3,000	100	Steel		Huge	Yes

7. PUMP STATION

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m3)	House size (m)	Rehabilitation Necessity (Y/N)
No							

8. PUBLIC TAPS

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
20	1970		No	0	Yes

9. DRAINAGE SYSTEM

Existence	Rehabilitation	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Gegharkunik
Number and Name of Community	No.1 Akunq
District	Vardenis

No.	Question	Answer
-----	----------	--------

A: Baseline Data

A1	Actual population in 2001	4,370
A2	Actual population in 2007	4,659
A3	Number of households	1,200
A4.1	Elderly people	523
A4.2	Population in labor force (age from 16 to 62)	2,556
A4.3	Children	1,474
A5.1	Pensioners	628
A5.2	Unemployed	0
A5.3	Receiving benefits	288
A6	Average monthly income of household (AMD)	17,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	870

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	3,600
	Annual Budget of the community 2005, in thousand AMD	4,000
	Annual Budget of the community 2006, in thousand AMD	4,200
	Annual Budget of the community 2007, in thousand AMD	3,800
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	300
	Amount spent in drinking water sector 2005, in thousand AMD	400
	Amount spent in drinking water sector 2006, in thousand AMD	350
	Amount spent in drinking water sector 2007, in thousand AMD	200
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned

C: Socio-Economic Survey

C1	Major industries of the community:	potatoes, cereals, dairy, meat
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no

D: Water Usage and Water Demand Survey

D1	Does the community hold water use permit? 1.Yes 2.No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	applicated
D5	Present condition of the water supply volume of Domestic use	sufficient
D6	Present condition of the water supply volume of Irrigation water	sufficient
D7	Number of house connection to drinking water system	1,000
D8	How many house connection household set the water meter	0
D9	Number of public taps	20
D10.1	How is the regime of water supply in your community in the dry season?	24 hrs
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	pleased
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (litter per day)	700

No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (litter per	800
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	spring
D20	Are you satisfied with irrigation water supply volume?	sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Voskanyan Bakhtibek
E2	Position	water distributor
E3	Telephone	with the help of administ. head
E4	Quantity and present condition of the water supply facilities: spring/ intake	1-deteriorated
E5	Quantity and present condition of the water supply facilities: pipeline/transmission	6-deteriorated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	1-partially rehabilitated
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	partially rehabilitated
E9	Quantity and present condition of the water supply facilities: pump	1-deteriorated, 1- part. rehabilit
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	community and residents
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	hired specialist fromcommunity(B. Voskanyan)
E14	How you prepare O&M costs?	keepings the payments, donation from residents
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	540,000
	Labor cost (AMD)	500 000
	Repair cost(AMD)	400,000
	Others(AMD)	0
	Total (AMD)	1,440,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	water fee

F: Initial Environmental Examination (IEE)

F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

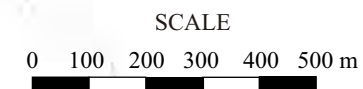
Gegharkunik
No.1 Akunq

	N	E	H (m)
A	40°09'20.0"	45°43'43.9"	1961
B	40°09'17.0"	45°43'47.8"	1998

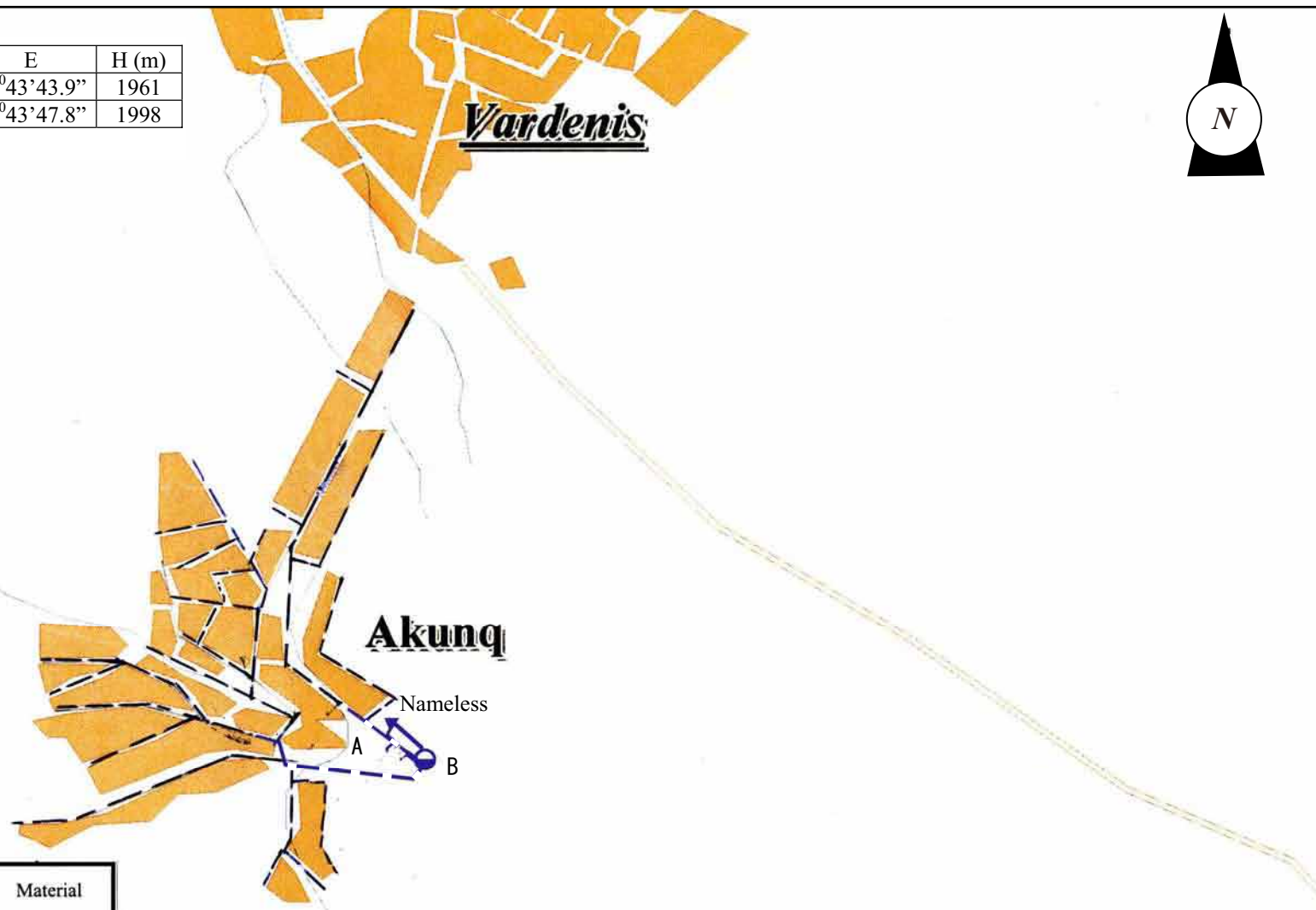


- LEGENDS**
-  Spring intake
 -  Operating DRR
 -  Transmission pipeline
 -  Distribution pipeline

Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
200	150	steel
DISTRIBUTION PIPELINE		
8500	150	steel
3000	100	



Gegharkunik Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
01	Akunq	JICA STUDY TEAM 2007

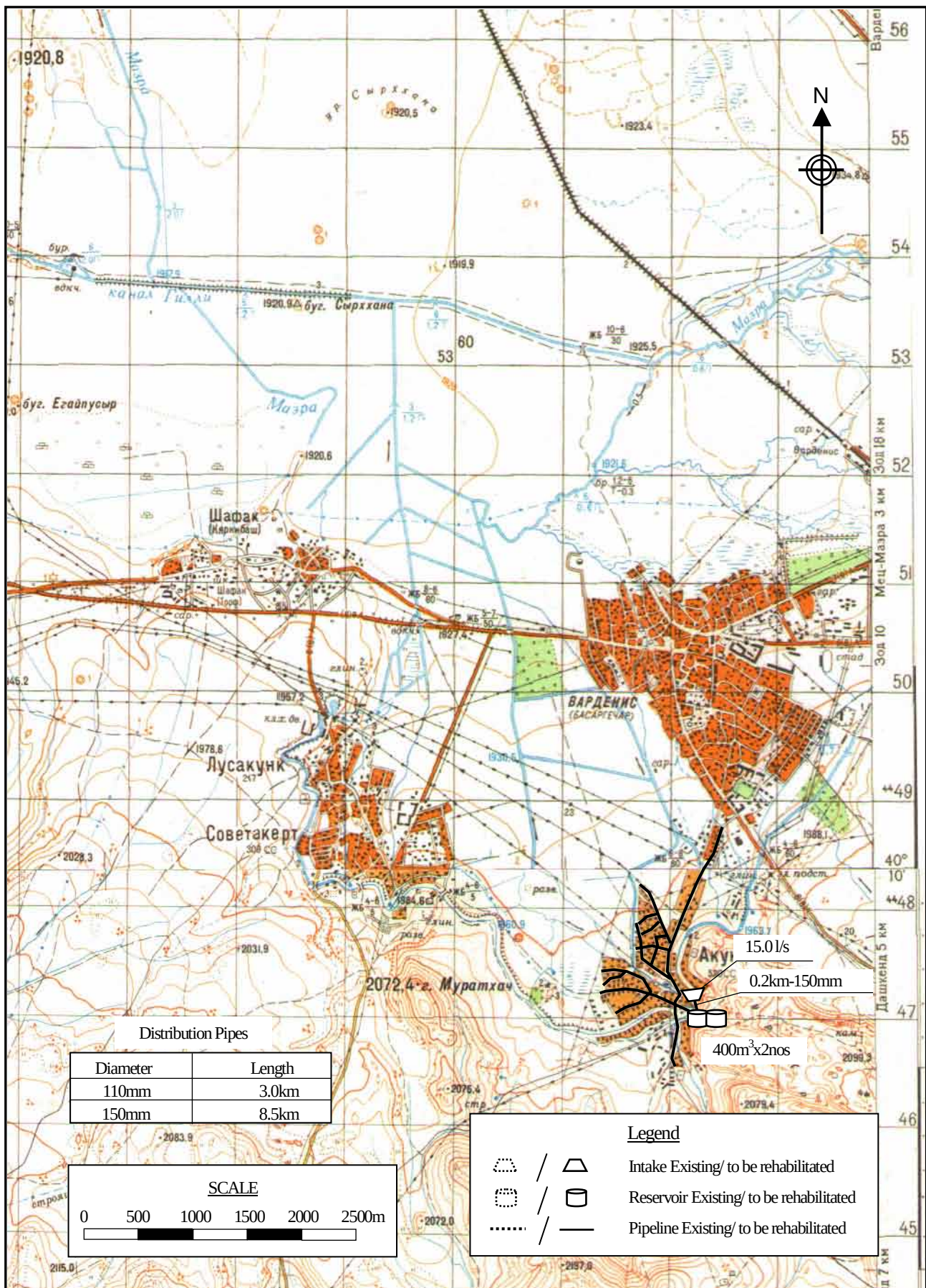


Marz : **Gegharkunik**
Name : **Akunq**

No.1

No.	Item	Quantity	Unit	Water demand (m3/d)	
A.	WATER DEMAND				
	1 Population	4,659	persons	465.9	
	2 Factory	-	nos	0.0	
	3 School (pupils)	870	pupils	8.7	
	4 Medical Ambulance Station	-	nos	-	
	5 Polyclinic	-	nos	-	
	7 Livestocks (87lit/household)	1,200	household	104.4	
	Sub-total			579.0	
	Unaccounted for water (20%)			115.8	
1	Average Daily Water Demand			694.8	m3/day
2	Maximum Daily Water Demand			833.8	m3/day
3	Maximum Hourly Water Demand			67.7	m3/hr
B	WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.		
	a Spring	1	15.0	lit/sec	1296.0 m3/day
	Total				1296.0 m3/day
	2 Required reservoir volume				813 m3

C	WATER SUPPLY FACILITIES REHABILITATION PLAN		
No	Item	Quantity	Unit
1	Intake		
	1m3	1	nos
	2m3		nos
	3m3		nos
	4m3		nos
2	Transmission pipe		
	50mm diameter		m
	75mm diameter		m
	90mm diameter		m
	110mm diameter		m
	150mm diameter	200	m
	200mm diameter		m
	250mm diameter		m
3	Reservoir		
	400m3 capacity	2	nos
4	Distribution pipe		
	50mm diameter		m
	75mm diameter		m
	90mm diameter		m
	110mm diameter	3,000	m
	150mm diameter	8,500	m
	200mm diameter		m
	250mm diameter		m
5	House connection	200	nos
6	Water meter installation	1,200	nos
7	Public tap	12	nos
8	Chlorination	1	nos
9	Pumps	-	nos



Water Supply Facilities Rehabilitation Plan

Marz Gegharkunik

No. 01 Akunq

The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia

JICA STUDY TEAM

STUDY FOR IMPROVEMENT OF
RURAL WATER SUPPLY AND
SEWAGE SYSTEMS IN RA

Marz : **Gegharkunik**

No. : **1**

Name : **Akunq**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	1	nos	367,700	367,700
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3	1	nos	805,100	805,100
	Sub-total					1,172,800
2	Transmission Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm	200	m	13,140	2,628,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					2,628,000
3	Reservoir					
		50m3		nos	8,363,900	
		100m3		nos	12,968,300	
		150m3		nos	18,804,500	
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3	2	nos	36,388,000	72,776,000
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					72,776,000
4	Distribution Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm	3,000	m	9,680	29,040,000
		150mm	8,500	m	13,140	111,690,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					140,730,000
5	House Connection		200	nos	74,000	14,800,000
6	Water Meter Installation		1,200	nos	80,000	96,000,000
7	Public Tap		12	nos	90,000	1,080,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage	concrete surfa	4,600	m	3,600	16,560,000
Total					AMD	346,246,800
					Equivalent to USD	1,133,303
					Equivalent to JPY	119,563,490
					AMD	USD
Investment Cost per household			1,200	HH	288,539	944
Investment Cost per person			4,659	persons	74,318	243

PROJECTED INCOME STATEMENT

PROJECTED CASH FLOW STATEMENT

PROJECTED CASH FLOW STATEMENT		Unit: million AMD																																							
Description		Year																																							
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
SOURCES OF FUNDS																																									
A Internal Cash Generation																																									
1. Net Income	611.56	-0.04	-0.07	0.17	1.02	1.32	-7.89	-2.52	-2.15	-1.76	-1.36	5.87	6.64	7.42	8.23	9.08	9.93	10.83	11.74	12.68	13.65	14.64	15.68	16.74	17.83	18.94	20.10	21.30	22.54	23.80	25.09	26.44	27.83	29.24	30.73	32.25	33.81	35.40	37.07	38.78	40.56
2. Depreciation cost	329.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
3. Interest Paid	100.48	0.04	0.07	1.75	3.48	4.27	4.27	4.27	4.27	4.27	4.28	4.15	4.03	3.91	3.78	3.65	3.52	3.39	3.26	3.13	2.99	2.86	2.72	2.58	2.44	2.30	2.16	2.01	1.87	1.72	1.57	1.42	1.27	1.12	0.96	0.80	0.65	0.49	0.33	0.16	
Sub-total	1041.04	0.00	0.00	1.92	4.50	5.59	5.78	11.15	11.52	11.91	12.31	19.55	20.19	20.85	21.54	22.26	22.98	23.75	24.53	25.34	26.18	27.03	27.94	28.86	29.81	30.78	31.80	32.86	33.95	35.07	36.21	37.41	38.65	39.91	41.25	42.61	44.01	45.45	46.96	48.51	50.12
B Finances																																									
1. Project Loan	427.79	3.91	2.79	167.98	173.17	78.91	0.58	0.45																																	
2. Local fund	146.13	1.29	0.91	56.91	59.50	27.39	0.07	0.06																																	
Sub-total	573.92	5.20	3.70	224.89	232.67	106.30	0.65	0.51																																	
C Subsidy from Government																																									
1. Subsidy for O&M cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Subsidy for debt services	0.11	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	0.11	0.04	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cash Inflow	1615.07	5.24	3.77	226.81	237.17	111.89	6.43	11.66	11.52	11.91	12.31	19.55	20.19	20.85	21.54	22.26	22.98	23.75	24.53	25.34	26.18	27.03	27.94	28.86	29.81	30.78	31.80	32.86	33.95	35.07	36.21	37.41	38.65	39.91	41.25	42.61	44.01	45.45	46.96	48.51	50.12
APPLICATION OF FUNDS																																									
D Project disbursement																																									
	573.92	5.20	3.70	224.89	232.67	106.30	0.65	0.51																																	
E Total debt services																																									
1. Loan repayment	427.84																																								

FINANCIAL ANALYSIS

Item	Million AMD	Rate
1 Revenue		
Water fee revenue	1,179.66	100.0%
Subsidy	0.11	0.0%
Total	1,179.77	100.0%
2 Expenditure		
OM cost	138.62	11.7%
Loan repayment	427.84	36.3%
Interest paid	100.48	8.5%
Surplus cash	512.83	43.5%
Total	1,179.77	100.0%

C. SENSITIVITY ANALYSIS

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	2.51%	2.25	44.40%
	2 Capital cost 20% up	2.01%	5.30	18.88%
2	1 OM cost 10% up	3.00%	0.23	430.56%
	2 OM cost 20% up	2.93%	0.48	209.86%
3	1 Revenue 10% down	2.38%	2.93	34.10%
	2 Revenue 20% down	1.62%	8.93	11.20%

No.2 Aghberq

Information on Existing Water Sources (Gegharkunik)

Study for Improvement of
Rural Water Supply and
Sewage Systems in RA

No.2 Community Aghberq
District Krasnoselsk
Marz Gegharkunik

No	Water source	Latitude			Longitude			Atitude	Yeild(L/sec)		
		deg	min	sec	deg	min	sec	(m)	Min	Max	At site
1	Spring	40	33	4.3	45	16	47.6	2,620	1.0	2.0	0.4
2	Spring	40	32	10.0	45	17	24.4	2,370			0.4
3	Spring	40	32	18.2	45	18	5.8	2,510			0.4
4	Spring	40	31	44.4	45	17	38.0	2,315			0.2
5											
6											
7											
8											
9											
10											
Notes:											
Latitude, Longitude, Atitude:		Measured at site									
Yield (Min, Max):		Interviewed to the Community									
Yield (at site):		Measured / estimated at site in summer of 2007									

Users Acceptnce for water quality	Acceptable
Notes	Leakage in the internal network - 80% approx. Spring intakes are not accessible. A total of 20 spring intakes are available in the existing spring area. The water amount can reach up to 3l/sec by repairing of the intakes
Alternative sources if any	Other sources are not needed.

No.2 Community Aghberq
District Krasnoselsk
Marz Gegharkunik
Sampling date 01/Sep/2007

	Parameters analysed	Units	No.1 Gurgenent aghbyur	No.2 Ashotents aghbyur	No.3 Gyughapetara ni aghbyur	No.4 Gyughaverji line	Guidelines	
							WHO	Armenia
a	pH		8.3	8.3	8.4	8.3	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	14.4	13.2	14.3	12.6		
c	TDS	Mg/L	122	152	163	133	1000	1000
1	Al:Aluminum	Mg/L	n.d.	n.d.	n.d.	n.d.	0.10	0.50
2	B:Boron	Mg/L	n.d.	n.d.	n.d.	n.d.	0.70	0.50
3	Cl:Chloride	Mg/L	4	7	5	5	250	350
4	Cr:Chrome	Mg/L	n.d.	n.d.	<0.01	n.d.	0.05	0.05
5	Cu:Copper	Mg/L	n.d.	n.d.	n.d.	n.d.	2	1
6	F:Fluoride	Mg/L	0.02	0.02	0.02	0.02	1.50	
7	Hardness	Mg/L	235	300	330	300	500	700
8	Fe:Iron	Mg/L	n.d.	n.d.	n.d.	0.02	0.30	0.30
9	Mn:Manganese	Mg/L	n.d.	n.d.	n.d.	n.d.	0.40	0.10
10	Mo:Molibdenum	Mg/L	<0.02	0.030	<0.02	n.d.	0.070	0.250
11	Ni:Nickel	Mg/L	<0.006	<0.006	n.d.	<0.006	0.020	0.100
12	Nitrate(NO3+)	Mg/L	3.1	4.4	4.0	4.9	50.0	45.0
13	SO4:Sulfate	Mg/L	4.0	7.0	10.0	7.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d.	n.d.	n.d.	n.d.	3.0	5.0
15	As:Arsenic	Mg/L	n.d.	n.d.	n.d.	n.d.	0.0	0.1
16	Ba:Barium	Mg/L	0.01	0.01	0.01	0.01	0.70	0.10
17	Be:Berillium	Mg/L	n.d.	n.d.	n.d.	n.d.	NA	0.00020
18	Cd:Cadmium	Mg/L	0.0002	0.0002	0.0001	0.0002	0.0030	0.0010
19	Pb:Lead	Mg/L	0.001	0.001	0.001	0.001	0.010	0.030
20	Hg:Mercury	Mg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.00100	0.00050
21	Se:Selenium	Mg/L	n.d.	n.d.	n.d.	<0.001	0.010	0.010
22	Sr:Strontium	Mg/L	<0.7	<0.7	<0.7	<0.7	NA	7.0
23	CN:Cyanide	Mg/L	n.d.	n.d.	n.d.	n.d.	0.070	0.035
24	Coli form bacteria	bacteria per 100 ml					-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml					0	0
26	Total bacteria	bacteria per 1 ml					-	50

Information on Existing Water Sources

Existing Bacteriological Test

Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.2	Community District Marz	Aghberq Krasnoselsk Gegharkunik
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No. 2 Marz Gegharkunik Community Aghberq**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Possible	Difficult	
2	Transmission pipeline	Possible	Possible	Pipeline is mostly far from the road
3	Reservoir	Possible	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°33'04.3"	45°16'47.6"	2,620	1952	Concrete	0.4	Yes
2	Spring	40°32'10.0"	45°17'24.4"	2,370	1970	Concrete	0.4	Yes
3	Spring	40°32'18.2"	45°18'05.8"	2,510	1952	Concrete	0.4	Yes
4	Spring	40°31'44.4"	45°17'38.0"	2,315	1952	Concrete	0.2	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	700	100	Steel	0.5	1970	Little	Yes
	800	50					Yes
2	300	50	Steel	0.5	1952	Little	Yes
3	700	50	Steel	0.5	1952	Little	Yes
4	2,000	75	Steel	0.3	1952	Little	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°32'02.8"	45°16'46.8"	2,199	Concrete	Rectangular	5x5x4	100	Yes
2	40°31'56.6"	45°17'03.5"	2,200	Concrete	Rectangular	5x5x4	100	Yes
3	40°31'47.3"	45°17'19.0"	2,209	Concrete	Rectangular	4x4x3	50	Yes
4	40°31'41.1"	45°17'28.7"	2,225	Concrete	Rectangular	5x5x4	100	Yes

5. CHLORINATION EQUIPMENT

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	8,000	50	Steel	1952	Huge	Yes

7. PUMP STATION

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m3)	House size (m)	Rehabilitation Necessity (Y/N)
No							

8. PUBLIC TAPS

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
4			No	0	Yes

9. DRAINAGE SYSTEM

Existence	Rehabilitation	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Gegharkunik
Number and Name of Community	No.2 Aghberq
District	Kranoseisk

No.	Question	Answer
A: Baseline Data		
A1	Actual population in 2001	355
A2	Actual population in 2007	316
A3	Number of households	81
A4.1	Elderly people	19
A4.2	Population in labor force (age from 16 to 62)	235
A4.3	Children	62
A5.1	Pensioners	30
A5.2	Unemployed	10
A5.3	Receiving benefits	29
A6	Average monthly income of household (AMD)	50,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	42

B: Budget		
B1	Annual Budget of the community 2004, in thousand AMD	3,450
	Annual Budget of the community 2005, in thousand AMD	3,540
	Annual Budget of the community 2006, in thousand AMD	3,720
	Annual Budget of the community 2007, in thousand AMD	3,974
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	0
	Amount spent in drinking water sector 2005, in thousand AMD	0
	Amount spent in drinking water sector 2006, in thousand AMD	0
	Amount spent in drinking water sector 2007, in thousand AMD	0
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned

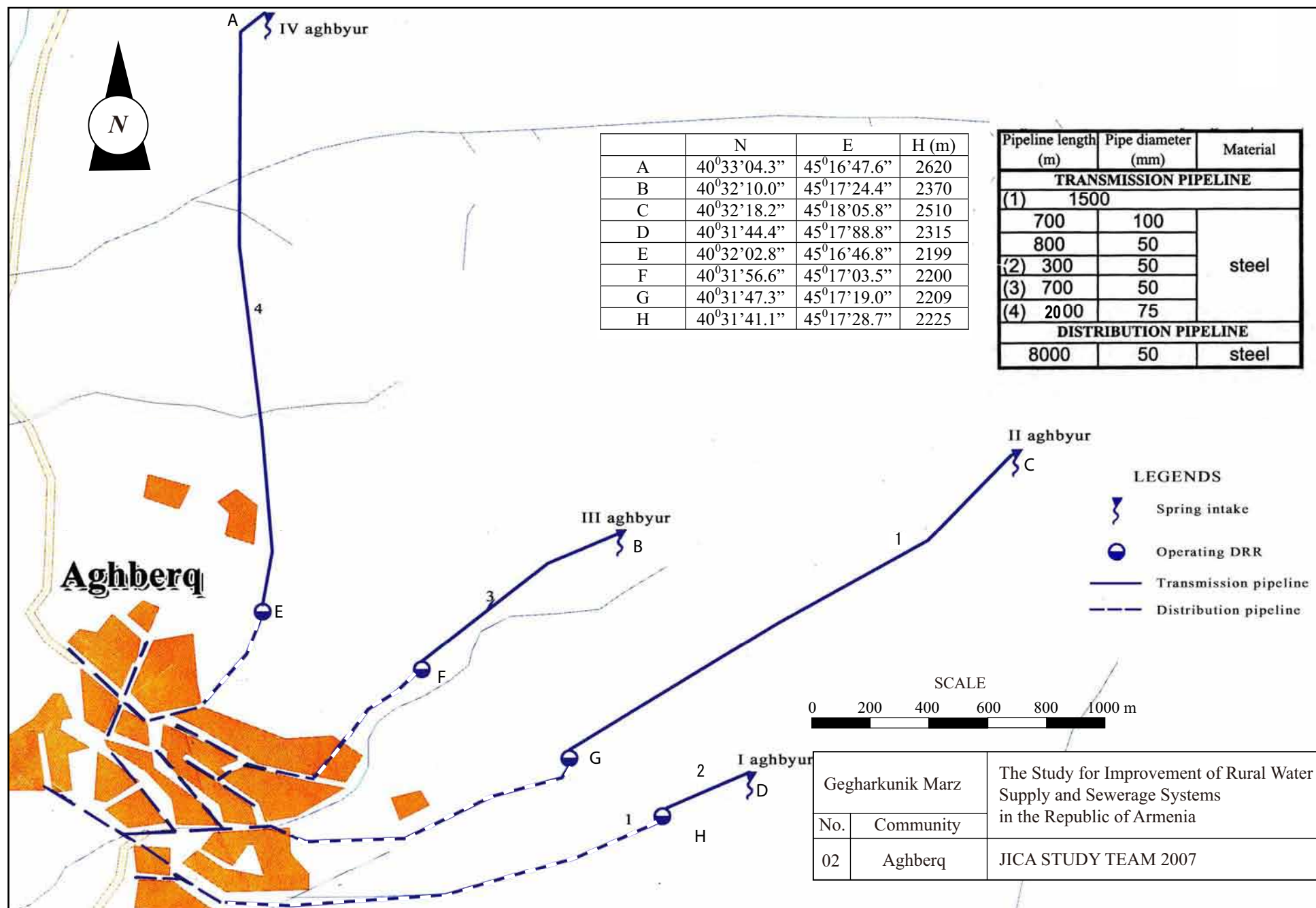
C: Socio-Economic Survey		
C1	Major industries of the community:	potatoes,cabbage, cereals, dairy, meat
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no

D: Water Usage and Water Demand Survey		
D1	Does the community hold water use permit? 1.Yes 2.No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	is not planned
D5	Present condition of the water supply volume of Domestic use	insufficient
D6	Present condition of the water supply volume of Irrigation water	absent
D7	Number of house connection to drinking water system	77
D8	How many house connection household set the water meter	0
D9	Number of public taps	0
D10.1	How is the regime of water supply in your community in the dry season?	24 hrs
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	pleased
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each houshold a day?	-
D14.2	Estimate quantity of domestic water use of each household (litter per day)	3,000

No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (litter per	3,000
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	absent
D20	Are you satisfied with irrigation water supply volume?	insufficient.

E: Present Operation and Maintenance Works		
E1	Name of responsible for water supply	nobody
E2	Position	
E3	Telephone	
E4	Quantity and present condition of the water supply facilities: spring/ intake	28-deteriorated
E5	Quantity and present condition of the water supply facilities: pipeline/transmission	4-deteriorated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	6-partially rehabilitated
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	absent
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	community, environmental organizations
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	administration head
E14	How you prepare O&M costs?	donation from various organizations
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	0
	Others(AMD)	0
	Total (AMD)	0
E16	Do the residents participate in the O&M works?	absent
E17	What kind of OM method is preferable to you?	residents participation, water fee reduction

F: Initial Environmental Examination (IEE)		
F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent



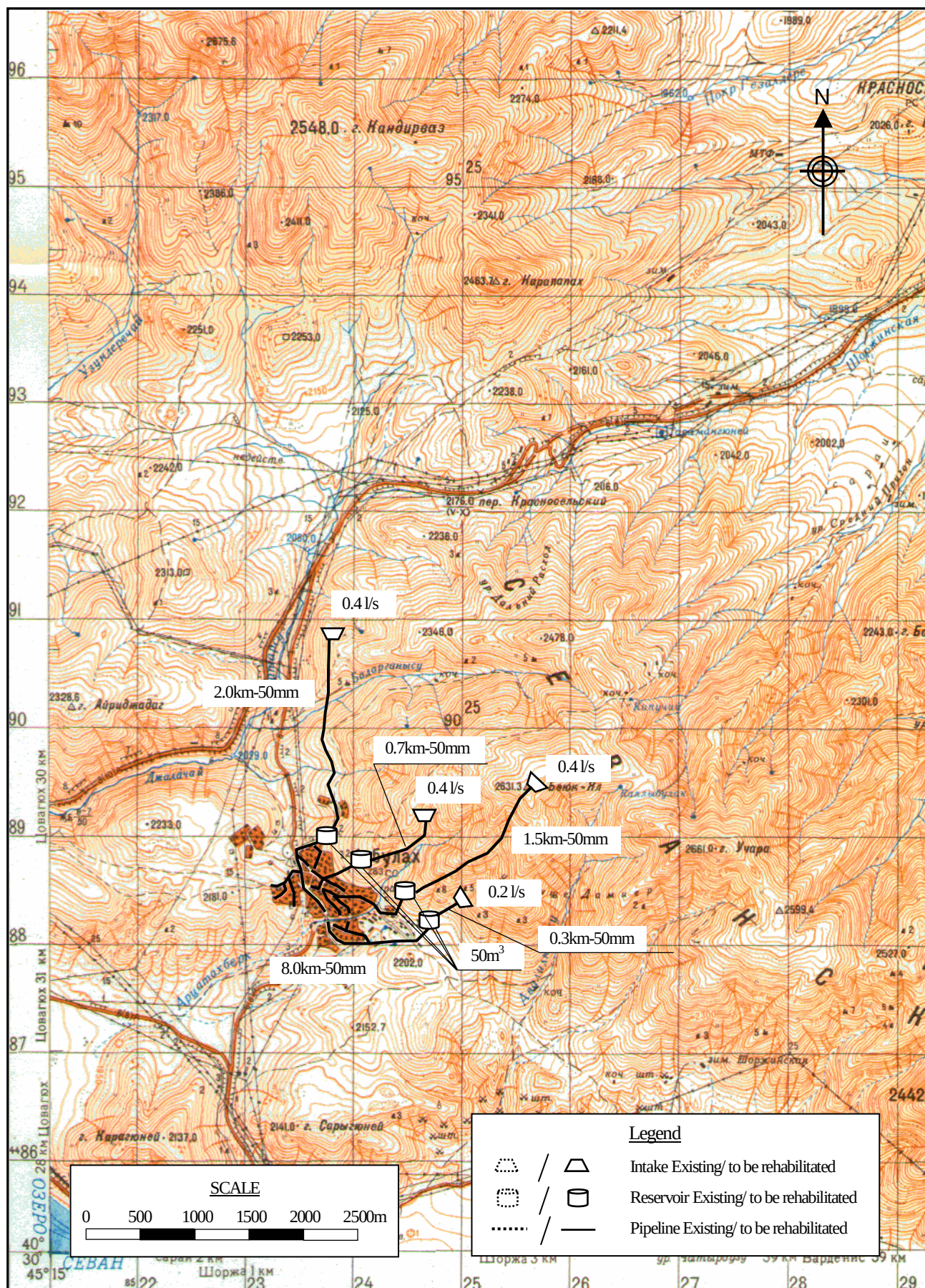
Marz : **Gegharkunik**
Name : **Aghberq**

No.2

No.	Item	Quantity	Unit	Water demand (m3/d)	
A.	WATER DEMAND				
	1 Population	316	persons	31.6	
	2 Factory	-	nos	0.0	
	3 School (pupils)	42	pupils	0.4	
	4 Medical Ambulance Station	-	nos	-	
	5 Polyclinic	-	nos	-	
	7 Livestocks (87lit/household)	81	household	7	
	Sub-total			39.0	
	Unaccounted for water (20%)			7.8	
1	Average Daily Water Demand			46.8	m3/day
2	Maximum Daily Water Demand			56.2	m3/day
3	Maximum Hourly Water Demand			10.6	m3/hr
B	WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.		
	a Spring	4	1.4	lit/sec	121.0 m3/day
	Total				121.0 m3/day
	2 Required reservoir volume				128 m3

C WATER SUPPLY FACILITIES REHABILITATION PLAN

No	Item	Quantity	Unit	
1	Intake			
	1m3	4	nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter	4,500	m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	50m3 capacity	4	nos	For each route
4	Distribution pipe			
	50mm diameter	8,000	m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	4	nos	
6	Water meter installation	81	nos	
7	Public tap	1	nos	
8	Chlorination	4	nos	
9	Pumps	-	nos	



Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Gegharkunik	
No. 02	Aghberq	
		JICA STUDY TEAM

Marz : **Gegharkunik**

No. : **2**

Name : **Aghberq**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	4	nos	367,700	1,470,800
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					1,470,800
2	Transmission Pipe					
		50mm	4,500	m	5,520	24,840,000
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					24,840,000
3	Reservoir					
		50m3	4	nos	8,363,900	33,455,600
		100m3		nos	12,968,300	
		150m3		nos	18,804,500	
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					33,455,600
4	Distribution Pipe					
		50mm	8,000	m	5,520	44,160,000
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					44,160,000
5	House Connection		4	nos	74,000	296,000
6	Water Meter Installation		81	nos	80,000	6,480,000
7	Public Tap		1	nos	90,000	90,000
8	Chlorilation Equipment		4	nos	500,000	2,000,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa		3,200	m	3,600	11,520,000
Total					AMD	124,312,400
					Equivalent to USD	406,888
					Equivalent to JPY	42,926,676
					AMD	USD
Investment Cost per household			81	HH	1,534,721	5,023
Investment Cost per person			316	persons	393,394	1,288

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS		
Item	Million AMD	Rate
1 Revenue		
Water fee revenue	79.87	31.7%
Subsidy	172.31	68.3%
Total	252.18	100.0%
2 Expenditure		
OM cost	53.97	21.4%
Loan repayment	160.37	63.6%
Interest paid	38.86	15.4%
Surplus cash	0.00	0.0%
Total	253.20	100.0%

B. FIRR CALCULATION

[illegible]

C. SENSITIVITY ANALYSIS

No.	Description	PV 1.75%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	1 Capital cost 10% up	-51.57	-4.20	-3.00	-148.1	-3.5	-1.5	-0.50	-0.29	0.20	0.23	0.26	4.83	4.86	4.88	4.91	4.94	4.98	4.99	5.02	5.05	5.08	5.10	5.13	5.16	5.18	5.22	5.24	5.26	5.29	5.31	5.33	5.36	5.38	5.41	5.42	5.44	5.45	5.48	5.50	5.52	5.53
	2 Capital cost 20% up	-65.51	-4.58	-3.28	-161.6	-3.8	-1.7	-0.56	-0.33	0.20	0.23	0.26	4.83	4.86	4.88	4.91	4.94	4.98	4.99	5.02	5.05	5.08	5.10	5.13	5.16	5.18	5.22	5.24	5.26	5.29	5.31	5.33	5.36	5.38	5.41	5.42	5.44	5.45	5.48	5.50	5.52	5.53
2	1 OM cost 10% up	-39.57	-3.82	-2.73	-134.7	-3.3	-1.5	-0.52	-0.32	0.13	0.16	0.19	4.76	4.79	4.81	4.84	4.87	4.91	4.92	4.95	4.98	5.01	5.03	5.06	5.09	5.11	5.15	5.17	5.19	5.22	5.24	5.26	5.29	5.31	5.34	5.35	5.37	5.38	5.41	5.43	5.45	5.46
	2 OM cost 20% up	-41.52	-3.82	-2.73	-134.8	-3.3	-1.5	-0.60	-0.40	0.05	0.08	0.11	4.68	4.71	4.73	4.76	4.79	4.83	4.84	4.87	4.90	4.93	4.95	4.98	5.01	5.03	5.07	5.09	5.11	5.14	5.16	5.18	5.21	5.23	5.26	5.27	5.29	5.30	5.33	5.35	5.37	5.38
3	1 Revenue 10% down	-49.75	-3.82	-2.73	-134.7	-3.3	-1.5	-0.53	-0.34	0.11	0.13	0.16	4.27	4.30	4.32	4.35	4.37	4.41	4.42	4.45	4.47	4.50	4.52	4.54	4.57	4.59	4.63	4.64	4.66	4.69	4.71	4.72	4.75	4.77	4.80	4.81	4.82	4.83	4.86	4.88	4.90	4.92
	2 Revenue 20% down	-61.88	-3.82	-2.73	-134.8	-3.3	-1.5	-0.61	-0.43	0.01	0.04	0.06	3.72	3.74	3.76	3.78	3.81	3.84	3.85	3.87	3.89	3.92	3.93	3.96	3.98	4.00	4.03	4.05	4.06	4.09	4.10	4.12	4.14	4.16	4.18	4.19	4.21	4.21	4.24	4.25	4.27	4.28

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	-0.12%	-35.95	-2.78%
	2 Capital cost 20% up	-0.49%	-16.14	-6.20%
2	1 OM cost 10% up	0.22%	3.57	28.00%
	2 OM cost 20% up	0.14%	11.20	8.93%
3	1 Revenue 10% down	-0.25%	-22.33	-4.48%
	2 Revenue 20% down	-0.85%	-13.55	-7.38%

No.3 Aygut

Information on Existing Water Sources (Gegharkunik)

Study for Improvement of
Rural Water Supply and
Sewage Systems in RA

No.3 Community Aygut
District Krasnoselsk
Marz Gegharkunik

No	Water source	Latitude			Longitude			Atitude	Yeild(L/sec)		
		deg	min	sec	deg	min	sec	(m)	Min	Max	At site
1	1st Spring	40	10	47.0	45	13	16.3	1,670	10	16	5.0
2	2nd Spring	40	41	48.5	45	11	25.3	1,662			3.5
3	3rd Spring	40	41	45.0	45	10	55.7	1,589			3.0
4	4th Spring	40	41	28.4	45	10	40.6	1,510			3.0
5											
6											
7											
8											
9											
10											
<i>Notes:</i>											
<i>Latitude, Longitude, Atitude:</i>		<i>Measured at site</i>									
<i>Yield (Min, Max):</i>		<i>Interviewed to the Community</i>									
<i>Yield (at site):</i>		<i>Measured / estimated at site in summer of 2007</i>									

Users Acceptnce for water quality	Acceptable
Notes	The road to the 1st spring was impassable due to mudflows. Water pipeline from the 2nd spring does not operate because of landslide.
Alternative sources if any	A total of 10 spring intakes have inside the boundary. Water supply will be improved through reconstruction of the reservoirs.

No.3 Community Aygut
District Krasnoselsk
Marz Gegharkunik
Sampling date 24/Jul/2007

	Parameters analysed	Units	No.1 at lake	No.2 meless	No.3 Murghuz	No.4 Gyoli aghbyur	Guidelines	
							WHO	Armenia
a	pH		8.0	8.0	7.9	8.0	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	13.5	12.7	16.5	17.6		
c	TDS	Mg/L	234	190	60	177	1000	1000
1	Al:Aluminum	Mg/L	n.d.	n.d.	n.d.	n.d.	0.10	0.50
2	B:Boron	Mg/L	n.d.	n.d.	n.d.	n.d.	0.70	0.50
3	Cl:Chloride	Mg/L	9	7	4	9	250	350
4	Cr:Chrome	Mg/L	n.d.	n.d.	< 0.01	n.d.	0.05	0.05
5	Cu:Copper	Mg/L	n.d.	n.d.	n.d.	n.d.	2	1
6	F:Fluoride	Mg/L	0.09	0.32	0.02	0.11	1.50	
7	Hardness	Mg/L	442	330	120	325	500	700
8	Fe:Iron	Mg/L	n.d.	n.d.	n.d.	n.d.	0.30	0.30
9	Mn:Manganese	Mg/L	n.d.	n.d.	n.d.	n.d.	0.40	0.10
10	Mo:Molibdenum	Mg/L	<0.02	<0.02	<0.02	n.d.	0.070	0.250
11	Ni:Nickel	Mg/L	n.d.	<0.006	n.d.	<0.006	0.020	0.100
12	Nitrate(NO3+)	Mg/L	3.6	1.3	0.9	3.6	50.0	45.0
13	SO4:Sulfate	Mg/L	43.0	39.0	4.0	44.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d.	n.d.	n.d.	n.d.	3.0	5.0
15	As:Arsenic	Mg/L	n.d.	n.d.	n.d.	n.d.	0.0	0.1
16	Ba:Barium	Mg/L	<0.01	<0.01	<0.01	<0.01	0.70	0.10
17	Be:Berillium	Mg/L	0.00005	0.00005	0.00005	0.00005	NA	0.00020
18	Cd:Cadmium	Mg/L	0.0002	0.0002	0.0001	0.0001	0.0030	0.0010
19	Pb:Lead	Mg/L	<0.001	<0.001	<0.001	<0.001	0.010	0.030
20	Hg:Mercury	Mg/L	n.d.	n.d.	n.d.	n.d.	0.00100	0.00050
21	Se:Selenium	Mg/L	0.001	0.001	0.001	0.001	0.010	0.010
22	Sr:Strontium	Mg/L	<0.7	<0.7	n.d.	<0.7	NA	7.0
23	CN:Cyanide	Mg/L	n.d.	n.d.	n.d.	n.d.	0.070	0.035
24	Coli form bacteria	bacteria per 100 ml					-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml					0	0
26	Total bacteria	bacteria per 1 ml					-	50

Information on Existing Water Sources

Existing Bacteriological Test

Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.3	Community	Aygut
	District	Krasnoselsk
	Marz	Gegharkunik

[illegible]

No. 3 Marz Gegharkunik Community Aygut**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Possible	Possible	
	Intake	Possible	Possible	
	Intake	Possible	Possible	
	Intake	Difficult	Difficult	
2	Transmission pipeline	Possible	Possible	Pipeline is generally along or close to the road
	Transmission pipeline	Possible	Possible	Pipeline is generally along or close to the road
	Transmission pipeline	Possible	Possible	Pipeline is generally along or close to the road
	Transmission pipeline	Difficult	Difficult	Difficult to find the pipeline route
3	Reservoirs	Fair	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°41'28.4"	45°10'40.6"	1,510	2004	Concrete	3.0	No
2	Spring	40°41'45.0"	45°10'55.7"	1,589	1998	Concrete	3.0	Yes
3	Spring	40°41'48.5"	45°11'25.3"	1,662	1960	Concrete	3.5	Yes
4	Spring	40°10'47.0"	45°13'16.3"	1,670	1970	Concrete	5.0	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	5,000	100	Cast iron, steel	2.0	1960	Huge	Yes
2	1,000	60	Polyethylene	-	1998	Non operating	Yes
	500	100	Cast iron				
3	1,000	80	Steel	2.0	1960	Huge	Yes
4	500	80	Steel	1.0	1970	Huge	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°41'24.9"	45°11'03.8"	1,556	Concrete	Rectangular	6x12x4	2x200	Yes
2	40°41'24.9"	45°11'03.8"	1,556	Concrete	Rectangular	6x6x4	100	Yes
3	40°41'25.9"	45°10'40.5"	1,491	Concrete	Circle	D=6m, H=4m	100	Yes

5. CHLORINATION EQUIPMENT

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	10,000	100	Steel	1960	Huge	Yes
2	12,000	50	Steel	1970	Huge	Yes

7. PUMP STATION

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m3)	House size (m)	Rehabilitation Necessity (Y/N)
No							

8. PUBLIC TAPS

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
5	1960		No	0	Yes

9. DRAINAGE SYSTEM

Existence	Rehabilitation Necessity	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Gegharkunik
Number and Name of Community	No.3 Aygut
District	Kranoseisk

No.	Question	Answer
A: Baseline Data		
A1	Actual population in 2001	1,100
A2	Actual population in 2007	1,050
A3	Number of households	347
A4.1	Elderly people	170
A4.2	Population in labor force (age from 16 to 62)	323
A4.3	Children	282
A5.1	Pensioners	320
A5.2	Unemployed	30
A5.3	Receiving benefits	120
A6	Average monthly income of household (AMD)	20,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	225

B: Budget		
B1	Annual Budget of the community 2004, in thousand AMD	4,000
	Annual Budget of the community 2005, in thousand AMD	4,000
	Annual Budget of the community 2006, in thousand AMD	5,000
	Annual Budget of the community 2007, in thousand AMD	5,000
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	0
	Amount spent in drinking water sector 2005, in thousand AMD	0
	Amount spent in drinking water sector 2006, in thousand AMD	0
	Amount spent in drinking water sector 2007, in thousand AMD	0
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned

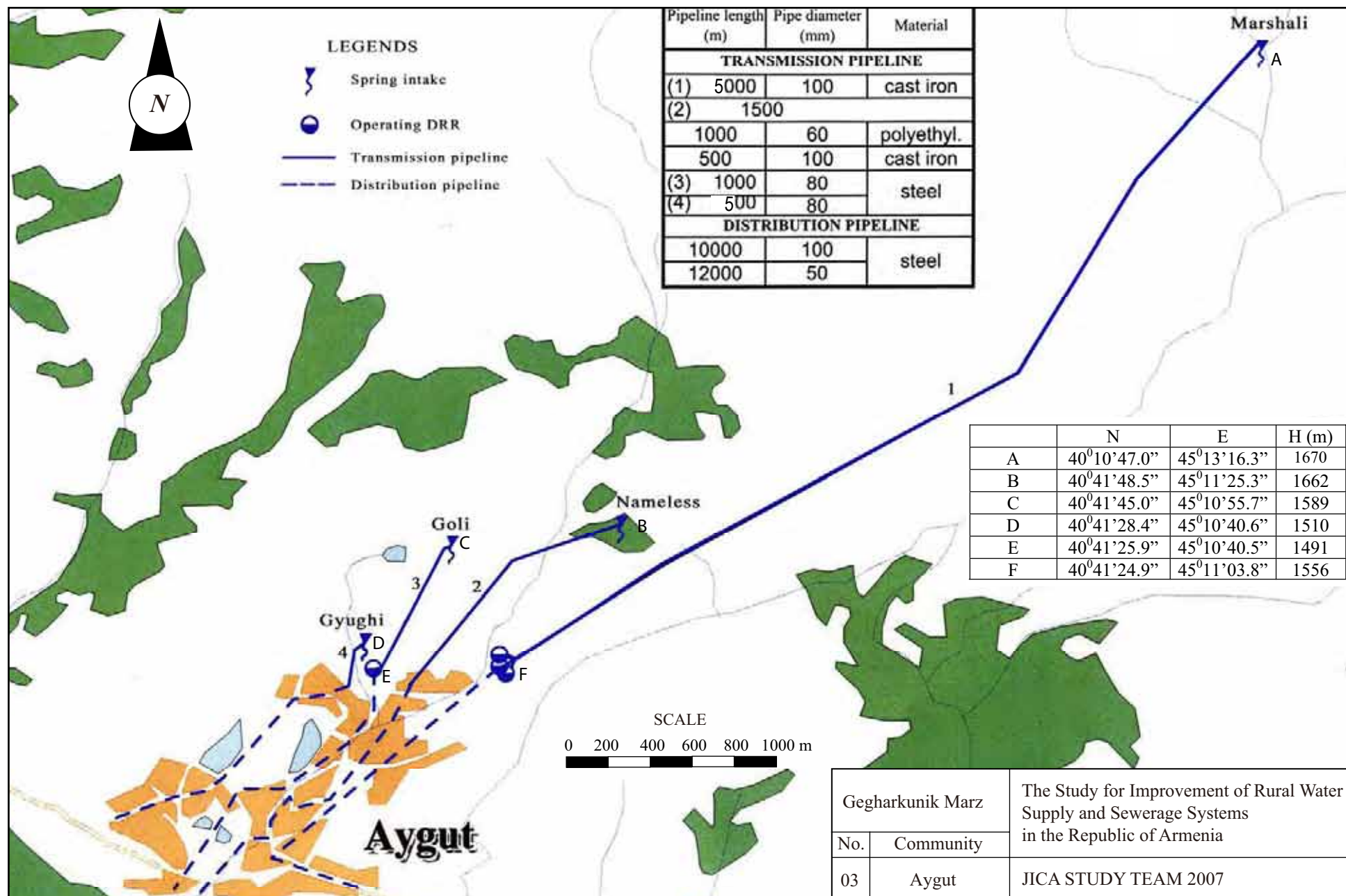
C: Socio-Economic Survey		
C1	Major industries of the community:	potatoes, dairy, meat
C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no

D: Water Usage and Water Demand Survey		
D1	Does the community hold water use permit? 1.Yes 2.No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	is not planned
D5	Present condition of the water supply volume of Domestic use	insufficient
D6	Present condition of the water supply volume of Irrigation water	absent
D7	Number of house connection to drinking water system	100
D8	How many house connection household set the water meter	0
D9	Number of public taps	6
D10.1	How is the regime of water supply in your community in the dry season?	no water at all
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	generally displeased
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (litter per day)	500

No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (litter per	500
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	absent
D20	Are you satisfied with irrigation water supply volume?	insufficient.

E: Present Operation and Maintenance Works		
E1	Name of responsible for water supply	nobody
E2	Position	
E3	Telephone	
E4	Quantity and present condition of the water supply facilities: spring/ intake	4-partially rehabilitated
E5	Quantity and present condition of the water supply facilities: pipeline/transmission	4-deteriorated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	4-deteriorated
E7	Quantity and present condition of the water supply facilities: net/distribution	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	deteriorated
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	community
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	specialist from community
E14	How you prepare O&M costs?	donation from residents
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	0
	Others(AMD)	0
	Total (AMD)	0
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	difficult to answer

F: Initial Environmental Examination (IEE)		
F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

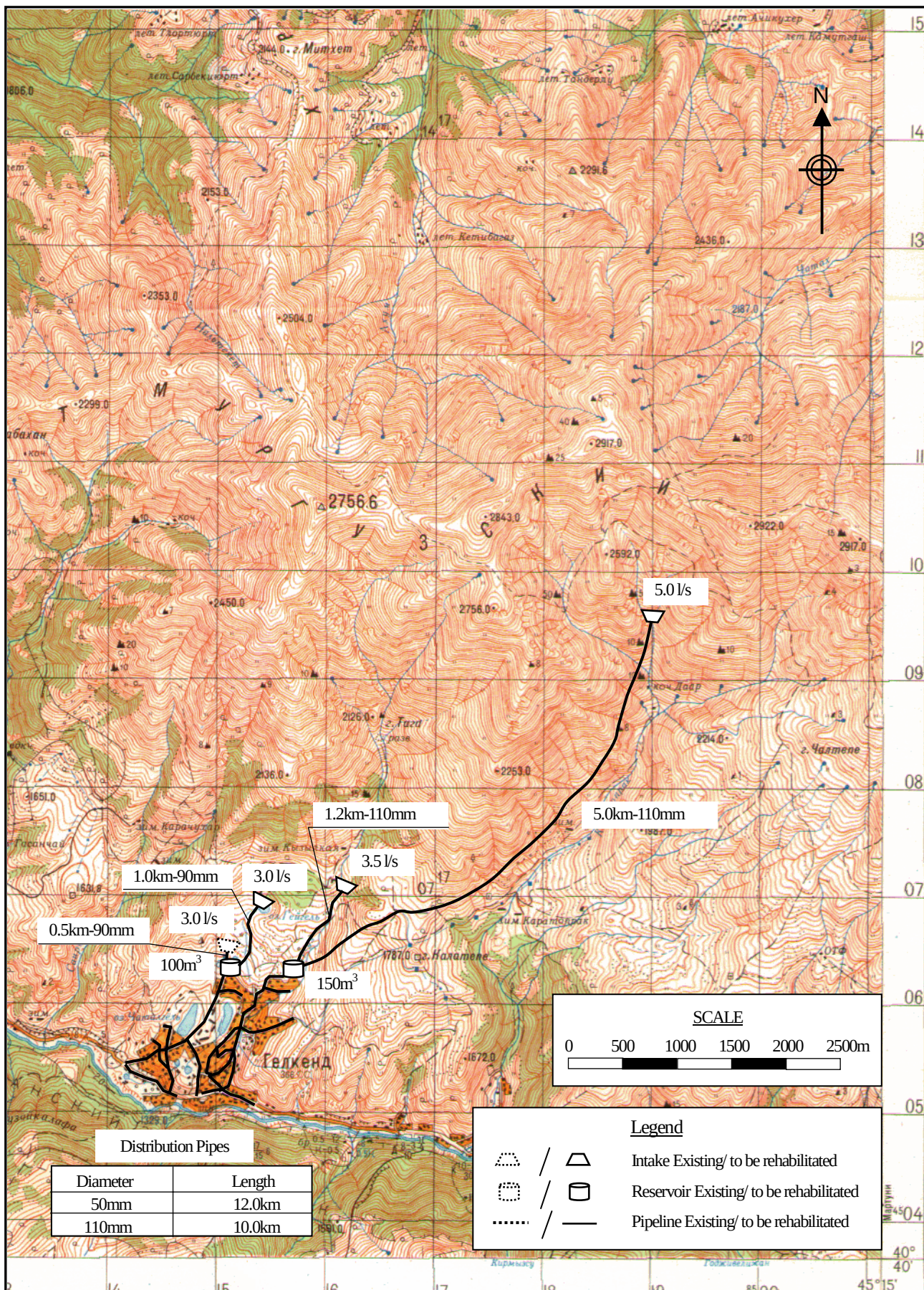


Marz : **Gegharkunik**
Name : **Aygut**

No.3

No.	Item	Quantity	Unit	Water demand (m3/d)	
A.	WATER DEMAND				
	1 Population	1,050	persons	105.0	
	2 Factory	-	nos	0.0	
	3 School (pupils)	225	pupils	2.3	
	4 Medical Ambulance Station	-	nos	-	
	5 Polyclinic	-	nos	-	
	7 Livestocks (87lit/household)	347	household	30.2	
	Sub-total			137.5	
	Unaccounted for water (20%)			27.5	
1	Average Daily Water Demand			165.0	m3/day
2	Maximum Daily Water Demand			198.0	m3/day
3	Maximum Hourly Water Demand			21.5	m3/hr
B	WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.		
	a Spring	4	14.5	lit/sec	1252.8 m3/day
	Total				1252.8 m3/day
	2 Required reservoir volume				257 m3

C	WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit		
1	Intake				
	1m3	3	nos		
	2m3		nos		
	3m3		nos		
	4m3		nos		
2	Transmission pipe				
	50mm diameter		m		
	75mm diameter		m		
	90mm diameter	1,500	m		
	110mm diameter	6,200	m		
	150mm diameter		m		
	200mm diameter		m		
	250mm diameter		m		
3	Reservoir				
	100m3 capacity	1	nos		
	150m3 capacity	1	nos		
4	Distribution pipe				
	50mm diameter	12,000	m		
	75mm diameter		m		
	90mm diameter		m		
	110mm diameter	10,000	m		
	150mm diameter		m		
	200mm diameter		m		
	250mm diameter		m		
5	House connection	247	nos		
6	Water meter installation	347	nos		
7	Public tap	4	nos		
8	Chlorination	2	nos		
9	Pumps	-	nos		



Water Supply Facilities Rehabilitation Plan

Marz	Gegharkunik
No. 03	Aygut

The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia

JICA STUDY TEAM

Marz : **Gegharkunik**

No. : **3**

Name : **Aygut**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	3	nos	367,700	1,103,100
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					1,103,100
2	Transmission Pipe					
		50mm		m	5,520	
		75mm		m	7,160	
		90mm	1,500	m	8,040	12,060,000
		110mm	6,200	m	9,680	60,016,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					72,076,000
3	Reservoir					
		50m3		nos	8,363,900	
		100m3	1	nos	12,968,300	12,968,300
		150m3	1	nos	18,804,500	18,804,500
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					31,772,800
4	Distribution Pipe					
		50mm	12,000	m	5,520	66,240,000
		75mm		m	7,160	
		90mm		m	8,040	
		110mm	10,000	m	9,680	96,800,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					163,040,000
5	House Connection		247	nos	74,000	18,278,000
6	Water Meter Installation		347	nos	80,000	27,760,000
7	Public Tap		4	nos	90,000	360,000
8	Chlorilation Equipment		2	nos	500,000	1,000,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage	concrete surfa	8,800	m	3,600	31,680,000
Total					AMD	347,069,900
					Equivalent to USD	1,135,997
					Equivalent to JPY	119,847,717
					AMD	USD
	Investment Cost per household		347	HH	1,000,201	3,274
	Investment Cost per person		1,050	persons	330,543	1,082

PROJECTED INCOME STATEMENT

[illegible]

PROJECTED CASH FLOW STATEMENT		Unit: million AMD																																								
Description		Year																																								
	Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
SOURCES OF FUNDS																																										
A Internal Cash Generation																																										
1. Net Income	-257.59	-0.04	-0.07	-0.35	-2.92	-4.11	-13.52	-12.29	-12.23	-12.19	-12.13	-10.46	-10.22	-9.99	-9.74	-9.49	-9.25	-8.98	-8.70	-8.44	-8.15	-7.87	-7.59	-7.30	-6.99	-6.67	-6.37	-6.05	-5.71	-5.37	-5.03	-4.68	-4.31	-3.94	-3.57	-3.17	-2.78	-2.37	-1.95	-1.51	-1.09	
2. Depreciation cost	329.70	0.00	0.00	0.00	0.00	0.00	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42	9.42		
3. Interest Paid	100.17	0.04	0.07	0.11	3.04	4.35	4.35	4.35	4.35	4.35	4.35	4.36	4.23	4.11	3.98	3.85	3.72	3.59	3.45	3.32	3.18	3.05	2.91	2.77	2.63	2.48	2.34	2.20	2.05	1.90	1.75	1.60	1.45	1.29	1.14	0.98	0.82	0.66	0.50	0.33	0.17	
Sub-total	172.28	0.00	0.00	-0.24	0.12	0.24	0.25	1.48	1.54	1.58	1.64	3.32	3.43	3.54	3.66	3.78	3.89	4.03	4.17	4.30	4.45	4.60	4.74	4.89	5.06	5.23	5.39	5.57	5.76	5.95	6.14	6.34	6.56	6.77	6.99	7.23	7.46	7.71	7.97	8.24	8.50	
B Finances																																										
1. Project Loan	435.71	3.91	2.79	4.12	293.80	130.06	0.58	0.45																																		
2. Local fund	150.44	1.29	0.91	1.40	101.31	45.40	0.07	0.06																																		
Sub-total	586.15	5.20	3.70	5.52	395.11	175.46	0.65	0.51																																		
C Subsidy from Government																																										
1. Subsidy for O&M cost	0.24	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2. Subsidy for debt services	363.35	0.04	0.07	0.11	2.92	4.11	4.10	2.87	2.81	2.77	2.71	13.57	13.45	13.35	13.23	13.10	12.99	12.86	12.71	12.58	12.43	12.29	12.14	11.99	11.83	11.65	11.49	11.32	11.12	10.93	10.74	10.54	10.33	10.11	9.90	9.65	9.42	9.17	8.92	8.64	8.39	
Sub-total	363.59	0.04	0.07	0.35	2.92	4.11	4.10	2.87	2.81	2.77	2.71	13.57	13.45	13.35	13.23	13.10	12.99	12.86	12.71	12.58	12.43	12.29	12.14	11.99	11.83	11.65	11.49	11.32	11.12	10.93	10.74	10.54	10.33	10.11	9.90	9.65	9.42	9.17	8.92	8.64	8.39	
Total Cash Inflow	1122.02	5.24	3.77	5.63	398.15	179.81	5.00	4.86	4.35	4.35	4.35	16.89	16.88	16.89	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.88	16.89	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89
APPLICATION OF FUNDS																																										
D Project disbursement																																										
	586.15	5.20	3.70	5.52	395.11	175.46	0.65	0.51																																		
E Total debt services																																										
1. Loan repayment	435.70											12.53	12.65	12.78	12.91	13.03	13.16	13.30	13.43	13.56	13.70	13.84	13.97	14.11	14.26	14.40	14.54	14.69	14.83	14.98	15.13	15.28	15.44	15.59	15.75	15.90	16.06	16.22	16.39	16.55	16.72	
2. Interest paid	100.17	0.04	0.07	0.11	3.04	4.35	4.35	4.35	4.35	4.35	4.35	4.36	4.23	4.11	3.98	3.85	3.72	3.59	3.45	3.32	3.18	3.05	2.91	2.77	2.63	2.48	2.34	2.20	2.05	1.90	1.75	1.60	1.45	1.29	1.14	0.98	0.82	0.66	0.50	0.33	0.17	
Sub-total	535.87	0.04	0.07	0.11	3.04	4.35	4.35	4.35	4.35	4.35	4.35	16.89	16.88	16.89	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.88	16.89	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89
Total Cash Outflow	1122.02	5.24	3.77	5.63	398.15	179.81	5.00	4.86	4.35	4.35	4.35	16.89	16.88	16.89	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.89	16.88	16.88	16.88	16.88	16.89	16.88	16.89	16.88	16.88	16.88	16.89	16.88	16.88	16.89
F Net Surplus Cash (A+C2)-E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Investment Cost Recovery Ratio (%)																																										
Cost recovery by water fee (A/E)	32%	0%	0%	0%	4%	6%	6%	34%	35%	36%	38%	20%	20%	21%	22%	23%	24%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%	36%	38%	39%	40%	41%	43%	44%	46%	47%	49%	50%			
Cost recovery by water fee + subsidy ((A+C2)/E)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
1 Revenue		
Water fee revenue	279.19	43.5%
Subsidy	363.35	56.5%
Total	642.54	100.0%
2 Expenditure		
OM cost	106.91	16.6%
Loan repayment	435.70	67.8%
Interest paid	100.17	15.6%
Surplus cash	0.00	0.0%
Total	642.78	100.0%

B. FIRR CALCULATION

[illegible]

C. SENSITIVITY ANALYSIS

No.	Description	PV 1.75%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
1	Capital cost 10% up	-134.89	-4.20	-3.00	-4.3	-285.6	-122.4	-0.19	1.22	1.79	1.89	2.01	12.95	12.96	12.98	12.99	12.99	13.01	13.01	13.00	13.00	12.99	12.98	12.97	12.96	12.94	12.91	12.89	12.86	12.81	12.77	12.73	12.68	12.62	12.56	12.50	12.41	12.34	12.25	12.16	12.05	11.96
2	Capital cost 20% up	-170.46	-4.58	-3.28	-4.7	-311.6	-133.6	-0.25	1.18	1.79	1.89	2.01	12.95	12.96	12.98	12.99	12.99	13.01	13.01	13.00	13.00	12.99	12.98	12.97	12.96	12.94	12.91	12.89	12.86	12.81	12.77	12.73	12.68	12.62	12.56	12.50	12.41	12.34	12.25	12.16	12.05	11.96
1	OM cost 10% up	-103.12	-3.82	-2.73	-3.9	-259.8	-111.4	-0.29	1.11	1.64	1.74	1.86	12.80	12.81	12.83	12.84	12.84	12.86	12.86	12.85	12.85	12.84	12.83	12.82	12.81	12.79	12.76	12.74	12.71	12.67	12.62	12.58	12.53	12.47	12.41	12.35	12.26	12.19	12.10	12.01	11.90	11.81
2	OM cost 20% up	-106.91	-3.82	-2.73	-3.9	-259.9	-111.5	-0.44	0.96	1.49	1.59	1.71	12.65	12.66	12.68	12.69	12.69	12.68	12.71	12.71	12.70	12.70	12.69	12.68	12.67	12.66	12.64	12.61	12.59	12.56	12.52	12.43	12.38	12.32	12.26	12.20	12.11	12.04	11.95	11.86	11.75	11.66
3	Revenue 10% down	-128.75	-3.82	-2.73	-3.9	-259.8	-111.4	-0.33	0.94	1.46	1.55	1.66	11.51	11.52	11.53	11.54	11.54	11.56	11.56	11.55	11.55	11.54	11.53	11.53	11.52	11.50	11.47	11.45	11.43	11.38	11.35	11.31	11.26	11.21	11.16	11.10	11.02	10.96	10.88	10.80	10.70	10.62
2	Revenue 20% down	-158.17	-3.82	-2.73	-3.9	-259.9	-111.6	-0.51	0.63	1.14	1.22	1.33	10.06	10.07	10.09	10.10	10.10	10.11	10.11	10.10	10.10	10.09	10.08	10.07	10.06	10.03	10.02	9.99	9.95	9.92	9.89	9.85	9.80	9.75	9.70	9.63	9.58	9.50	9.43	9.34	9.27	

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	-0.36%	-12.67	-7.89%
	2 Capital cost 20% up	-0.77%	-11.25	-8.89%
2	1 OM cost 10% up	0.03%	24.24	4.13%
	2 OM cost 20% up	-0.04%	-33.76	-2.96%
3	1 Revenue 10% down	-0.48%	-12.00	-8.33%
	2 Revenue 20% down	-1.12%	-10.86	-9.21%

No.4 Ayrq

Information on Existing Water Sources (Gegharkunik)

Study for Improvement of
Rural Water Supply and
Sewage Systems in RA

No.4 Community Ayrq
District Vardenis
Marz Gegharkunik

No	Water source	Latitude			Longitude			Atitude (m)	Yeild(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	spring	-	-	-	-	-	-	-	2.0	3.0	1.5
2											
3											
4											
5											
6											
7											
8											
9											
10											
<i>Notes:</i>											
<i>Latitude, Longitude, Atitude:</i>		<i>Measured at site</i>									
<i>Yield (Min, Max):</i>		<i>Interviewed to the Community</i>									
<i>Yield (at site):</i>		<i>Measured / estimated at site in summer of 2007</i>									

Users Acceptnce for water quality	Acceptable
Notes	It was impossible to reach springs.
Alternative sources if any	There is no alternative water source.

No.4 Community Ayrq
District Vardenis
Marz Gegharkunik
Sampling date 25/Aug/2007

	Parameters analysed	Units	No.1				Guidelines	
							WHO	Armenia
a	pH		8.4				6.5-8	6.0 - 9.0
b	Temperature	Deg.C	13.1					
c	TDS	Mg/L	67				1000	1000
1	Al:Aluminum	Mg/L	n.d				0.10	0.50
2	B:Boron	Mg/L	n.d				0.70	0.50
3	Cl:Chloride	Mg/L	3				250	350
4	Cr:Chrome	Mg/L	<0.01				0.05	0.05
5	Cu:Copper	Mg/L	n.d				2	1
6	F:Fluoride	Mg/L	0.05				1.50	
7	Hardness	Mg/L	130				500	700
8	Fe:Iron	Mg/L	n.d				0.30	0.30
9	Mn:Manganese	Mg/L	n.d				0.40	0.10
10	Mo:Molibdenum	Mg/L	n.d				0.070	0.250
11	Ni:Nickel	Mg/L	n.d				0.020	0.100
12	Nitrate(NO3+)	Mg/L	2.7				50.0	45.0
13	SO4:Sulfate	Mg/L	3.0				250.0	500.0
14	Zn:Zink	Mg/L	n.d				3.0	5.0
15	As:Arsenic	Mg/L	n.d				0.0	0.1
16	Ba:Barium	Mg/L	<0.01				0.70	0.10
17	Be:Berillium	Mg/L	0.00010				NA	0.00020
18	Cd:Cadmium	Mg/L	n.d				0.0030	0.0010
19	Pb:Lead	Mg/L	0.001				0.010	0.030
20	Hg:Mercury	Mg/L	n.d				0.00100	0.00050
21	Se:Selenium	Mg/L	0.001				0.010	0.010
22	Sr:Strontium	Mg/L	<0.7				NA	7.0
23	CN:Cyanide	Mg/L	n.d				0.070	0.035
24	Coli form bacteria	bacteria per 100 ml					-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml					0	0
26	Total bacteria	bacteria per 1 ml					-	50

Information on Existing Water Sources

Existing Bacteriological Test

Study for Improvement of Rural Water Supply and Sewage Systems in RA

No.4	Community	Ayrq
	District	Vardenis
	Marz	Gegharkunik

[illegible]

No. 4 Marz Gegharkunik Community Ayrq**1. ACCESSIBILITY TO THE SITE**

No.	Structures	Access by vehicle	Machine construction	Remarks
1	Intake	Difficult	Difficult	
2	Transmission pipeline	Difficult	Difficult	Pipeline is mostly far from the road
3	Reservoir	Possible	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	—	—	-	1950	Concrete	1.5	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	21,000	150	Steel	1.5	1950	Medium	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°07'12.8"	45°48'17.9"	2186	Concrete	Rectangular	6x5x18	60	Yes

5. CHLORINATION EQUIPMENT

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No			

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	2,500	100	Steel	1950	Huge	Yes
2	1,500	50	Steel		Huge	Yes

7. PUMP STATION

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m3)	House size (m)	Rehabilitation Necessity (Y/N)
No							

8. PUBLIC TAPS

No. of taps	Old one (year)	New one (year)	Valves (Y/N)	Valve rate (%)	Rehabilitation Necessity (Y/N)
6			No	0	Yes

9. DRAINAGE SYSTEM

Existence	Rehabilitation	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Gegharkunik
Number and Name of Community	No.4 Ayrq
District	Vardenis

No.	Question	Answer
A: Baseline Data		
A1	Actual population in 2001	468
A2	Actual population in 2007	518
A3	Number of households	105
A4.1	Elderly people	285
A4.2	Population in labor force (age from 16 to 62)	138
A4.3	Children	95
A5.1	Pensioners	298
A5.2	Unemployed	6
A5.3	Receiving benefits	11
A6	Average monthly income of household (AMD)	13,000
A7	Number of medical ambulance staion/first and health post	absent
A8	Number of beds in each medical ambulance staion	0
A9	Number of school	1
A10	Number of pupils	81

B: Budget		
B1	Annual Budget of the community 2004, in thousand AMD	7,000
	Annual Budget of the community 2005, in thousand AMD	7,000
	Annual Budget of the community 2006, in thousand AMD	9,000
	Annual Budget of the community 2007, in thousand AMD	4,800
	Annual Budget of the community 2008, in thousand AMD	is not planned
B2	Amount spent in drinking water sector 2004, in thousand AMD	0
	Amount spent in drinking water sector 2005, in thousand AMD	1,500
	Amount spent in drinking water sector 2006, in thousand AMD	0
	Amount spent in drinking water sector 2007, in thousand AMD	0
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned

C: Socio-Economic Survey		
C1	Major industries of the community:	cereals

C2	Is there any community activities carrying out by women? 1-Yes, 2-No	no
----	--	----

D: Water Usage and Water Demand Survey

D1	Does the community hold water use permit? 1.Yes 2.No	no
D2	Water use permit number	-
D3	Date of expiry of water use permit	-
D4	Planned date of obtaining water use permit	unknown
D5	Present condition of the water supply volume of Domestic use	sufficient
D6	Present condition of the water supply volume of Irrigation water	sufficient
D7	Number of house connection to drinking water system	105
D8	How many house connection household set the water meter	0
D9	Number of public taps	0
D10.1	How is the regime of water supply in your community in the dry season?	24 hrs
D10.2	How is the regime of water supply in your community in the wet season?	24 hrs
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	-
D13	Are hours of water supply convenient?	-
D14.1	How long the taps are open to provide the domestic water (cooking, washing, foodstuffs, dishes, Landry, bathing, etc) of each household a day?	-
D14.2	Estimate quantity of domestic water use of each household (litter per day)	250

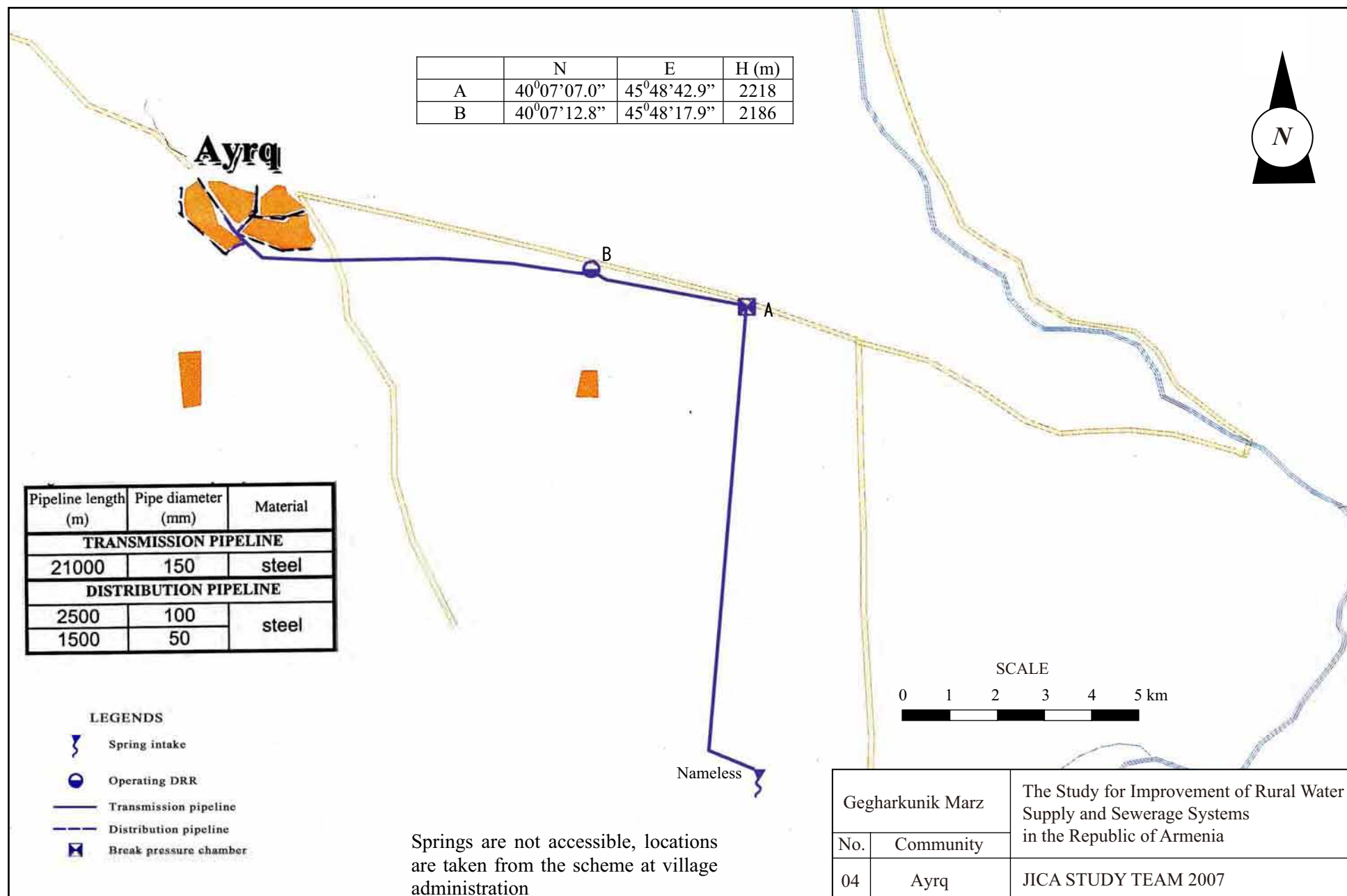
No.	Question	Answer
D15.1	How long the taps are open to provide the each household for filling	1 hour
D15.2	Estimate quantity of water for filling containers of each household (litter per	-
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	from the river
D20	Are you satisfied with irrigation water supply volume?	sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Zaqovan Gagik
E2	Position	water distributor
E3	Telephone	with the help of administ. head
E4	Quantity and present condition of the water supply facilities: spring/ intake	2 -rehabilitated
E5	Quantity and present condition of the water supply facilities: pipeline/transmission	2- rehabilitated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	1- rehabilitated
E7	Quantity and present condition of the water supply facilities: net/distribution	partially rehabilitated
E8	Quantity and present condition of the water supply facilities: public tap	absent
E9	Quantity and present condition of the water supply facilities: pump	absent
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	community and residents
E12	How do you repair the water supply facilities?	by ourselves
E13	Who is in charge of the repair work in the community?	administration head
E14	How you prepare O&M costs?	community staff
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	1,500,000
	Others(AMD)	0
	Total (AMD)	1,500,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	residents participation, water fee reduction

F: Initial Environmental Examination (IEE)

F1	Are any of the following areas located inside or around the project site?	
F1.1	National park, protected area designated by the government (coast line, water lands, reserved are for ethnic or indigenous people, cultural heritage), and areas being considered for national parks or proposed areas.	absent
F1.2	Virgin forests, tropical forests	absent
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	absent
F1.4	Habit of valuable species protected by domestic laws or international treaties	absent
F1.5	Likely salts cumulus or soil erosion areas on a massive scale	absent
F1.6	Remarkable desertification trend areas	absent
F1.7	Archaeological historical or cultural valuable areas	absent
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

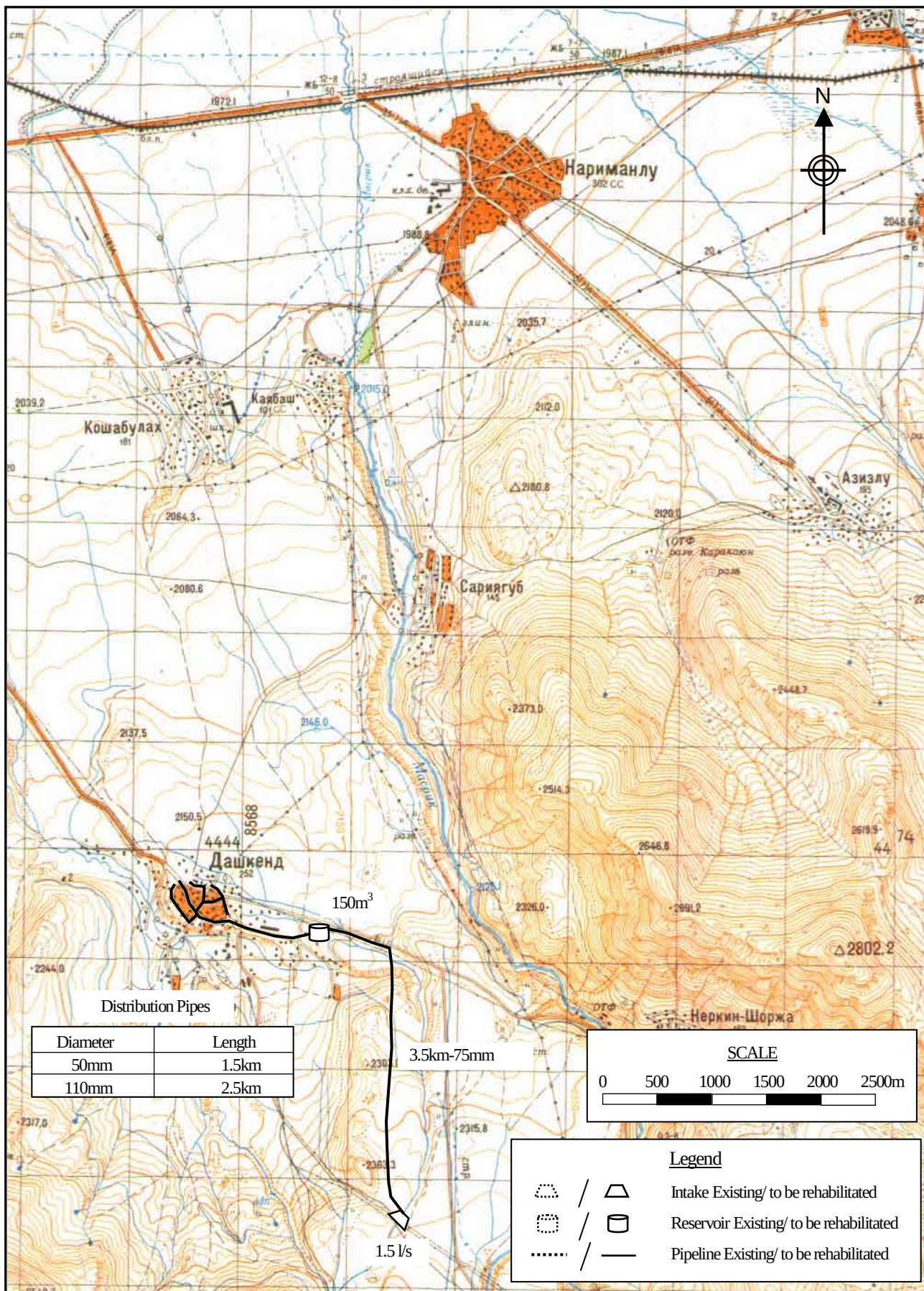


Marz : **Gegharkunik**
Name : **Ayrq**

No.4

No.	Item	Quantity	Unit	Water demand (m3/d)	
A.	WATER DEMAND				
	1 Population	518	persons	51.8	
	2 Factory	-	nos	0.0	
	3 School (pupils)	81	pupils	0.8	
	4 Medical Ambulance Station	-	nos	-	
	5 Polyclinic	-	nos	-	
	7 Livestocks (87lit/household)	105	household	9.1	
	Sub-total			61.7	
	Unaccounted for water (20%)			12.3	
1	Average Daily Water Demand			74.0	m3/day
2	Maximum Daily Water Demand			88.8	m3/day
3	Maximum Hourly Water Demand			12.0	m3/hr
B	WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.		
	a Spring	1	1.5	lit/sec	129.6 m3/day
	Total				129.6 m3/day
	2 Required reservoir volume				144 m3

C	WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit		
1	Intake				
	1m3	1	nos		
	2m3		nos		
	3m3		nos		
	4m3		nos		
2	Transmission pipe				
	50mm diameter		m		
	75mm diameter	3,500	m		
	90mm diameter		m		
	110mm diameter		m		
	150mm diameter		m		
	200mm diameter		m		
	250mm diameter		m		
3	Reservoir				
	150m3 capacity	1	nos		
4	Distribution pipe				
	50mm diameter	1,500	m		
	75mm diameter		m		
	90mm diameter		m		
	110mm diameter	2,500	m		
	150mm diameter		m		
	200mm diameter		m		
	250mm diameter		m		
5	House connection	-	nos		
6	Water meter installation	105	nos		
7	Public tap	2	nos		
8	Chlorination	1	nos		
9	Pumps	-	nos		



Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Gegharkunik	
No. 04	Ayrq	
		JICA STUDY TEAM

Marz : **Gegharkunik**

No. : **4**

Name : **Ayrq**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake					
		1m3	1	nos	367,700	367,700
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					367,700
2	Transmission Pipe					
		50mm		m	5,520	
		75mm	3,500	m	7,160	25,060,000
		90mm		m	8,040	
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					25,060,000
3	Reservoir					
		50m3		nos	8,363,900	
		100m3		nos	12,968,300	
		150m3	1	nos	18,804,500	18,804,500
		200m3		nos	22,524,600	
		250m3		nos	25,952,800	
		300m3		nos	29,630,400	
		350m3		nos	33,528,700	
		400m3		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					18,804,500
4	Distribution Pipe					
		50mm	1,500	m	5,520	8,280,000
		75mm		m	7,160	
		90mm		m	8,040	
		110mm	2,500	m	9,680	24,200,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					32,480,000
5	House Connection			nos	74,000	
6	Water Meter Installation		105	nos	80,000	8,400,000
7	Public Tap		2	nos	90,000	180,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa		1,600	m	3,600	5,760,000
Total					AMD	91,552,200
					Equivalent to USD	299,660
					Equivalent to JPY	31,614,157
					AMD	USD
Investment Cost per household			105	HH	871,926	2,854
Investment Cost per person			518	persons	176,742	578

PROJECTED INCOME STATEMENT

Description

Unit: million AMD

PROJECTED CASH FLOW STATEMENT		Unit: million AMD																																									
Description	Total	Year																																									
SOURCES OF FUNDS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
A Internal Cash Generation																																											
1. Net Income	-78.50	-0.04	-0.07	-0.84	-1.43	-1.72	-4.21	-3.67	-3.68	-3.68	-3.67	-2.95	-2.89	-2.82	-2.76	-2.69	-2.62	-2.56	-2.48	-2.41	-2.34	-2.27	-2.19	-2.11	-2.03	-1.96	-1.88	-1.79	-1.70	-1.62	-1.53	-1.43	-1.35	-1.25	-1.15	-1.05	-0.95	-0.84	-0.73	-0.62	-0.52		
2. Depreciation cost	86.80	0.00	0.00	0.00	0.00	0.00	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	2.48	
3. Interest Paid	29.49	0.04	0.07	0.54	1.02	1.24	1.25	1.25	1.25	1.25	1.25	1.25	1.22	1.18	1.14	1.11	1.07	1.03	0.99	0.95	0.91	0.87	0.84	0.79	0.75	0.71	0.67	0.63	0.59	0.55	0.50	0.46	0.42	0.37	0.33	0.28	0.24	0.19	0.14	0.10	0.05		
Sub-total	37.79	0.00	0.00	-0.30	-0.41	-0.48	-0.48	0.06	0.05	0.05	0.06	0.78	0.81	0.84	0.86	0.90	0.93	0.95	0.99	1.02	1.05	1.08	1.13	1.16	1.20	1.23	1.27	1.32	1.37	1.41	1.45	1.51	1.55	1.60	1.66	1.71	1.77	1.83	1.89	1.96	2.01		
B Finances																																											
1. Project Loan	125.12	3.91	2.79	47.16	48.24	21.99	0.58	0.45																																			
2. Local fund	42.24	1.29	0.91	15.97	16.24	7.70	0.07	0.06																																			
Sub-total	167.36	5.20	3.70	63.13	64.48	29.69	0.65	0.51																																			
C Subsidy from Government																																											
1. Subsidy for O&M cost	1.67	0.00	0.00	0.30	0.41	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2. Subsidy for debt services	115.14	0.04	0.07	0.54	1.02	1.24	1.25	1.19	1.20	1.20	1.19	1.07	1.04	1.01	0.99	0.95	0.92	0.90	0.86	0.82	0.79	0.76	0.72	0.68	0.64	0.61	0.58	0.53	0.48	0.44	0.40	0.34	0.30	0.25	0.19	0.14	0.08	0.02	0.96	0.28	2.89	2.84	
Sub-total	116.81	0.04	0.07	0.84	1.43	1.72	1.73	1.19	1.20	1.20	1.19	1.07	1.04	1.01	0.99	0.95	0.92	0.90	0.86	0.82	0.79	0.76	0.72	0.68	0.64	0.61	0.58	0.53	0.48	0.44	0.40	0.34	0.30	0.25	0.19	0.14	0.08	0.02	0.96	0.28	2.89	2.84	
Total Cash Inflow	321.96	5.24	3.77	63.67	65.50	30.93	1.90	1.76	1.25	1.25	1.25	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.84	4.84	4.84	4.85	4.84	4.84	4.84	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85
APPLICATION OF FUNDS																																											
D Project disbursement	167.36	5.20	3.70	63.13	64.48	29.69	0.65	0.51																																			
E Total debt services																																											
1. Loan repayment	125.11											3.60	3.63	3.67	3.71	3.74	3.78	3.82	3.86	3.89	3.93	3.97	4.01	4.05	4.09	4.13	4.18	4.22	4.26	4.30	4.35	4.39	4.43	4.48	4.52	4.57	4.61	4.66	4.71	4.75	4.80		
2. Interest paid	29.49	0.04	0.07	0.54	1.02	1.24	1.25	1.25	1.25	1.25	1.25	1.25	1.22	1.18	1.14	1.11	1.07	1.03	0.99	0.95	0.91	0.87	0.84	0.79	0.75	0.71	0.67	0.63	0.59	0.55	0.50	0.46	0.42	0.37	0.33	0.28	0.24	0.19	0.14	0.10	0.05		
Sub-total	154.60	0.04	0.07	0.54	1.02	1.24	1.25	1.25	1.25	1.25	1.25	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.84	4.84	4.84	4.85	4.84	4.84	4.84	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85
Total Cash Outflow	321.96	5.24	3.77	63.67	65.50	30.93	1.90	1.76	1.25	1.25	1.25	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.84	4.84	4.84	4.85	4.84	4.84	4.84	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85	4.85
F Net Surplus Cash (A+C2)-E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Investment Cost Recovery Ratio (%)																																											
Cost recovery by water fee (A/E)	24%	0%	0%	0%	0%	0%	0%	5%	4%	4%	5%	16%	17%	17%	18%	19%	19%	20%	20%	21%	22%	22%	23%	24%	25%	25%	26%	27%	28%	29%	30%	31%	32%	33%	34%	35%	36%	38%	39%	40%	41%		
Cost recovery by water fee + subsidy ((A+C2)/E)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

GEGHARKUNIK MARZ
Marutuni District
No 4 Ayraq

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS

Item	Millon AMD	Rate
1 Revenue		
Water fee revenue	125.69	52.2%
Subsidy	115.14	47.8%
Total	240.83	100.0%
2 Expenditure		
OM cost	87.90	36.5%
Loan repayment	125.11	51.9%
Interest paid	29.49	12.2%
Surplus cash	0.00	0.0%
Total	242.50	100.0%

B. FIRR CALCULATION

Description	Total	Year																																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
A COST																																											
1. Investment Cost	112.31	3.82	2.73	43.12	42.75	18.94	0.53	0.42																																			
2. Operation and Maintenance Cost																																											
Salary	9.12			0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	
Chlorine	2.98			0.03	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	
Electricity	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Maintenance cost	32.76			0.36	0.72	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	
Pump replacement	0.00																																										
Sub-total	44.86			0.63	1.03	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Total Outflow	157.17	3.82	2.73	43.75	43.78	20.14	1.73	1.62	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
B BENEFIT																																											
1. Water Tariff	78.80	0.00	0.00	0.33	0.66	0.81	0.84	1.42	1.47	1.51	1.56	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.34	
2. Subsidy	87.54	0.00	0.00	0.30	0.41	0.48	0.48	0.00	0.00	0.00	0.00	2.82	2.82	2.83	2.85	2.84	2.85	2.87	2.87	2.87	2.88	2.89	2.88	2.89	2.89	2.90	2.91	2.90	2.89	2.89	2.90	2.88	2.88	2.88	2.86	2.86	2.84	2.83	2.82	2.79	2.79	2.79	2.79
Total Inflow	166.34	0.00	0.00	0.63	1.07	1.29	1.32	1.42	1.47	1.51	1.56	5.16	5.16	5.17	5.19	5.18	5.19	5.21	5.21	5.21	5.22	5.23	5.22	5.23	5.23	5.24	5.25	5.24	5.23	5.23	5.24	5.22	5.22	5.22	5.20	5.20	5.18	5.17	5.16	5.13	5.13	5.13	
NET BENEFIT	9.16	-3.82	-2.73	-43.1	-42.7	-18.9	-0.41	-0.20	0.27	0.31	0.36	3.96	3.96	3.97	3.99	3.98	3.99	4.01	4.01	4.01	4.02	4.03	4.02	4.03	4.03	4.04	4.05	4.04	4.03	4.03	4.04	4.02	4.02	4.02	4.00	4.00	3.98	3.97	3.96	3.93	3.93	3.93	
FIRR =	0.37%																																										

C. SENSITIVITY ANALYSIS

No.	Description	PV 1.75%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
1	1 Capital cost 10% up	-36.72	-4.20	-3.00	-47.4	-47.0	-20.7	-0.46	-0.24	0.27	0.31	0.36	3.96	3.96	3.97	3.99	3.98	3.99	4.01	4.01	4.01	4.02	4.03	4.02	4.03	4.03	4.04	4.04	4.05	4.04	4.03	4.03	4.04	4.02	4.02	4.02	4.00	4.00	3.98	3.97	3.96	3.93	3.93
	2 Capital cost 20% up	-47.27	-4.58	-3.28	-51.7	-51.3	-22.6	-0.52	-0.28	0.27	0.31	0.36	3.96	3.96	3.97	3.99	3.98	3.99	4.01	4.01	4.01	4.02	4.03	4.02	4.03	4.03	4.04	4.05	4.04	4.03	4.03	4.04	4.02	4.02	4.02	4.00	4.00	3.98	3.97	3.96	3.93	3.93	
2	1 OM cost 10% up	-29.31	-3.82	-2.73	-43.2	-42.8	-19.0	-0.53	-0.32	0.15	0.19	0.24	3.84	3.84	3.85	3.87	3.86	3.87	3.89	3.89	3.89	3.90	3.91	3.90	3.91	3.91	3.92	3.93	3.92	3.91	3.91	3.92	3.90	3.90	3.90	3.88	3.88	3.86	3.85	3.84	3.81	3.81	
	2 OM cost 20% up	-32.44	-3.82	-2.73	-43.2	-42.9	-19.1	-0.65	-0.44	0.03	0.07	0.12	3.72	3.72	3.73	3.75	3.74	3.75	3.77	3.77	3.77	3.78	3.79	3.78	3.79	3.79	3.80	3.81	3.80	3.79	3.79	3.80	3.78	3.78	3.78	3.76	3.76	3.74	3.73	3.72	3.69	3.69	
3	1 Revenue 10% down	-37.23	-3.82	-2.73	-43.2	-42.8	-19.0	-0.54	-0.34	0.12	0.16	0.20	3.44	3.44	3.45	3.47	3.46	3.47	3.49	3.49	3.49	3.50	3.51	3.50	3.51	3.51	3.52	3.53	3.52	3.51	3.51	3.52	3.50	3.50	3.50	3.48	3.48	3.46	3.45	3.44	3.42	3.42	
	2 Revenue 20% down	-48.29	-3.82	-2.73	-43.2	-42.9	-19.1	-0.67	-0.48	-0.02	0.01	0.05	2.93	2.93	2.94	2.95	2.94	2.95	2.97	2.97	2.97	2.98	2.98	2.98	2.98	2.99	3.00	2.99	2.98	2.98	2.99	2.98	2.98	2.98	2.96	2.96	2.94	2.94	2.93	2.90	2.90		

No.	Description	FIRR	Sensitivity indicator	Swiching value
1	1 Capital cost 10% up	-0.08%	-56.96	-1.76%
	2 Capital cost 20% up	-0.48%	-17.70	-5.65%
2	1 OM cost 10% up	0.19%	9.42	10.61%
	2 OM cost 20% up	0.01%	461.06	0.22%
3	1 Revenue 10% down	-0.31%	-21.65	-4.62%
	2 Revenue 20% down	-1.07%	-13.40	-7.46%