

No.10 Arayi

Information on Existing Water Sources (Aragatsotn)

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

No.10 Community Arayi
District Aparan
Marz Aragatsotn

No.10 Community Arayi
District Aparan
Marz Aragatsotn
Sampling date 14/Aug/2007

No	Water source	Latitude			Longitude			Atitude	Yeild(L/sec)		
		deg	min	sec	deg	min	sec	(m)	Min	Max	At site
1	Amrai 3 springs	40	26	48.1	44	21	38.5	1,891	4.0	10.0	7.0
2	Chakhoyh spring	40	26	38.8	44	21	29.7	1,907	0.1	1.0	0.5
3	Urtst spring	40	27	25.4	44	22	15.7	1,881	0.5	3.0	1.5
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	The spring intakes are destroyed. There are leakage found.
Alternative sources if any	No alternative water sources are available

	Parameters analysed	Units	No.1	No.2	Guidelines	
					WHO	Armenia
a	pH		7.2	7.4	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	7.4	8		
c	TDS	Mg/L	23	31	1000	1000
1	Al:Aluminum	Mg/L	n.d	0.03	0.10	0.50
2	B:Boron	Mg/L	<0.2	<0.2	0.70	0.50
3	Cl:Chloride	Mg/L	5	4	250	350
4	Cr:Chrome	Mg/L	<0.01	0.01	0.05	0.05
5	Cu:Copper	Mg/L	n.d	n.d	2	1
6	F:Fluoride	Mg/L	0.08	0.09	1.50	
7	Hardness	Mg/L	45	85	500	700
8	Fe:Iron	Mg/L	n.d	n.d	0.30	0.30
9	Mn:Manganese	Mg/L	n.d	n.d	0.40	0.10
10	Mo:Molibdenum	Mg/L	<0.02	0.040	0.070	0.250
11	Ni:Nickel	Mg/L	0.006	n.d	0.020	0.100
12	Nitrate(NO3+)	Mg/L	1.3	2.7	50.0	45.0
13	SO4:Sulfate	Mg/L	2.0	3.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d	n.d	3.0	5.0
15	As:Arsenic	Mg/L	n.d	n.d	0.0	0.1
16	Ba:Barium	Mg/L	<0.01	n.d	0.70	0.10
17	Be:Berillium	Mg/L	0.00005	0.00005	NA	0.00020
18	Cd:Cadmium	Mg/L	n.d	n.d	0.0030	0.0010
19	Pb:Lead	Mg/L	0.001	<0.001	0.010	0.030
20	Hg:Mercury	Mg/L	<0.0002	<0.0002	0.00100	0.00050
21	Se:Selenium	Mg/L	n.d	n.d	0.010	0.010
22	Sr:Strontium	Mg/L	n.d	<0.7	NA	7.0
23	CN:Cyanide	Mg/L	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

No. 10 Marz Aragatsotn Community Arayi**1. ACCESSIBILITY TO THE SITE**

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

2. INTAKE STRUCTURE

No.	Water main	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°26'48.1"	44°21'38.5"	1,891	1963	RC	7.0	Yes
2	Spring	40°26'38.8"	44°21'29.7"	1,907	1990	RC	0.5	Yes
3	Spring	40°27'25.4"	44°22'15.7"	1,881	2005	RC	1.5	No

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	800	300	Asbestos cement	3.2	1963	Medium	Yes
	2,500	300	Steel		1973	Little	Yes
	200	150	Steel		1973	Little	Yes
2	2,700	150	Steel	0.4	1990	Little	Yes
	1,000	100	Steel		1990	Little	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	No							

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	2,300	100	Steel	1985	Little	Yes
2	1,000	80	Steel		Little	Yes
3	1,850	50	Steel		Little	Yes
4	200	150	Polyethylene	2001	Little	Yes
5	200	80	Polyethylene		Little	Yes
6	700	50	Polyethylene		Little	Yes
7	250	25	Polyethylene		Little	Yes
8	300	100	AsbestosCemen	1975	Medium	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)
50	1975	1985	Yes	80	Yes

9. DRAINAGE SYSTEM

Existence	Rehabilitation Necessity	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.10 Arayi
District	Aparan

No.	Question	Answer
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A: Baseline Data

A1	Actual population in 2001	584
A2	Actual population in 2007	628
A3	Number of households	187
A4.1	Elderly people	250
A4.2	Population in labor force (age from 16 to 62)	279
A4.3	Children	131
A5.1	Pensioners	120
A5.2	Unemployed	0
A5.3	Receiving benefits	7
A6	Average monthly income of household (AMD)	30,000
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	120

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	600
	Annual Budget of the community 2005, in thousand AMD	1,000
	Annual Budget of the community 2006, in thousand AMD	1,000
	Annual Budget of the community 2007, in thousand AMD	600
	Annual Budget of the community 2008, in thousand AMD	2
B2	Amount spent in drinking water sector 2004, in thousand AMD	500
	Amount spent in drinking water sector 2005, in thousand AMD	0
	Amount spent in drinking water sector 2006, in thousand AMD	4,000
	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:	dairy, meat, vegetables
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	almost sufficient
D6	Present condition of the water supply volume of Irrigation water	sufficient
D7	Number of house connection to drinking water system	187
D8	How many house connection household set the water meter	0
D9	Number of public taps	3
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?	very 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)	400
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	1,100
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1-Flat 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

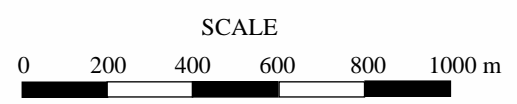
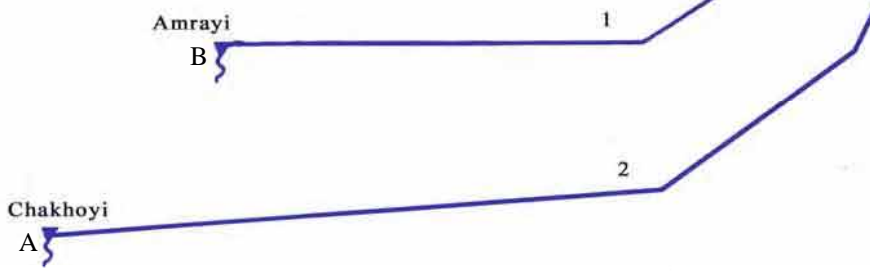
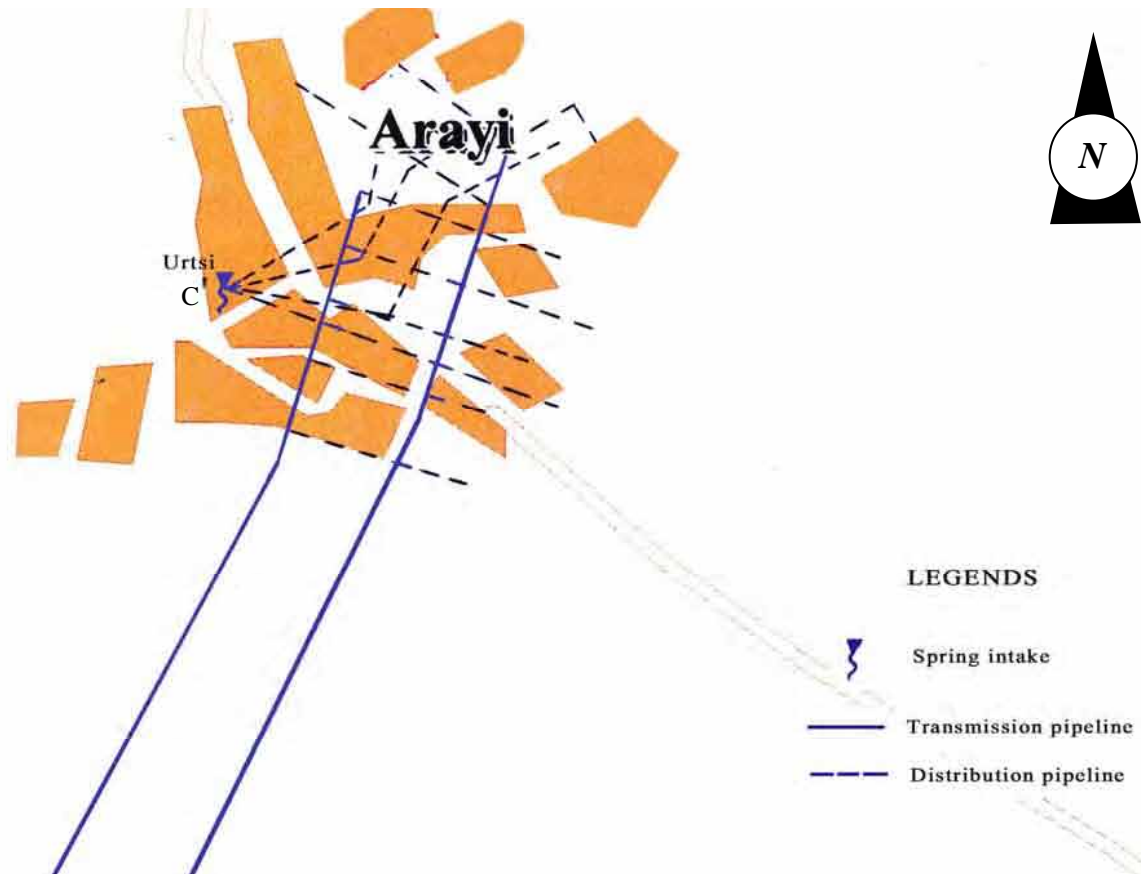
E1	Name of responsible for water supply	nobody
E2	Position	-
E3	Telephone	-
E4	Quantity and present condition of the water supply facilities: spring/ intake	2 rehabilitated
E5	Quantity and present condition of the water supply facilities:	2 rehabilitated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	2 partially repaired
E7	Quantity and present condition of the water supply facilities: net/distribution pipes	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	partially repaired
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?	residents
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?	community budget
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	4,000,000
	Others(AMD)	0
	Total (AMD)	4,000,000
E16	Do the residents participate in the O&M works?	earthwork, welding
E17	What kind of OM method is preferable to you?	resident participation

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	yes
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

	N	E	H (m)
A	40°26'38.8"	44°21'29.7"	1907
B	40°26'48.1"	44°21'38.5"	1891
C	40°27'25.4"	44°22'15.7"	1881

Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
1. 3500		
800	300	Asbestos
2500	300	Steel
200	150	
2. 3700		
2700	150	Steel
1000	100	
DISTRIBUTION PIPELINE		
1850	50	Steel
1000	80	
2300	100	
250	25	Polyethelene
700	50	
200	80	
200	150	
300	100	Asbestos



Aragatsotn Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
10	Arayi	JICA STUDY TEAM 2007

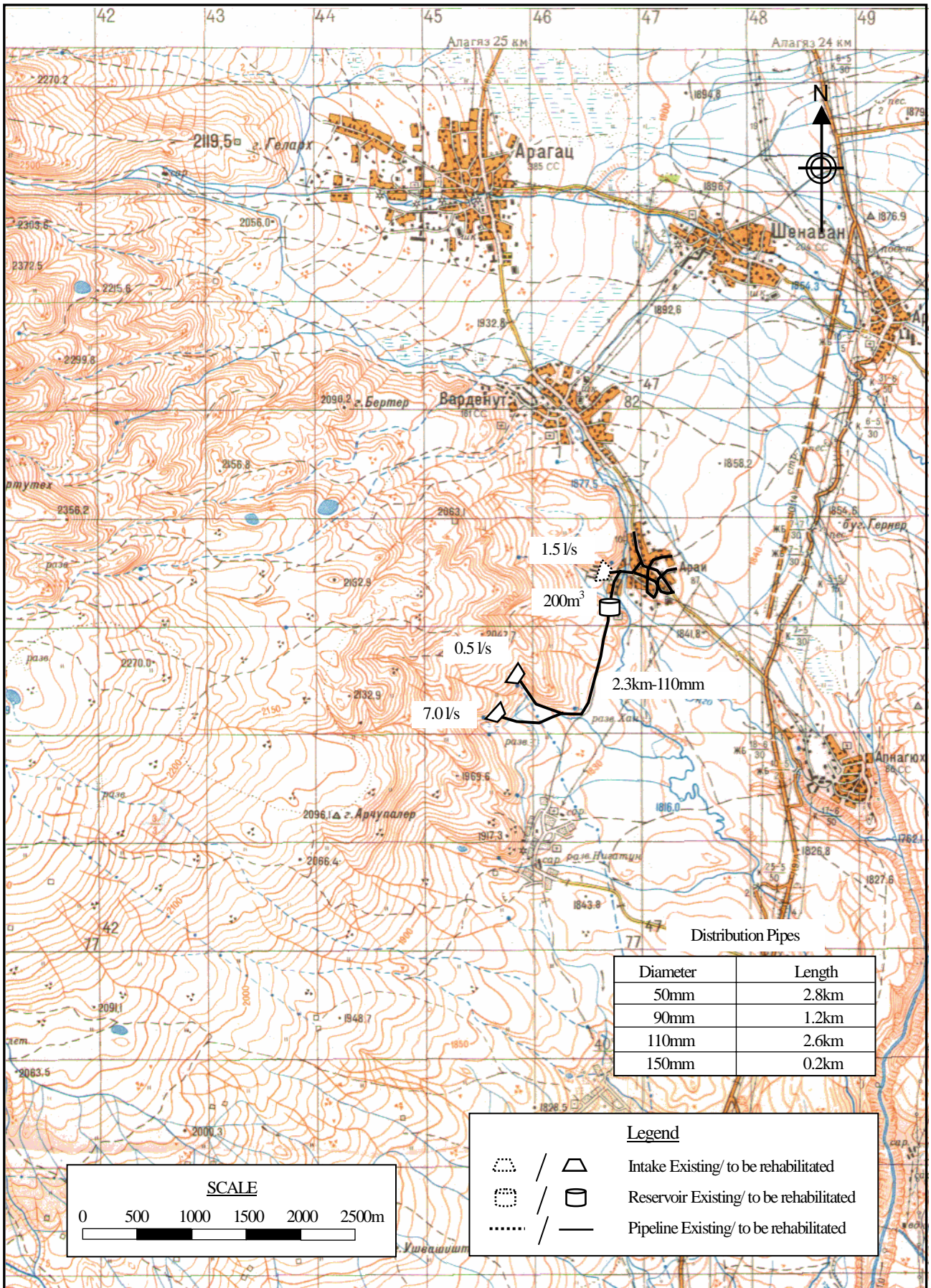
Marz : **Aragatsotn**
Name : **Arayi**

No.10

No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
	1 Population	628	persons	62.8
	2 Factory	-	nos	0.0
	3 School (pupils)	120	pupils	1.2
	4 Medical Ambulance Station	-	nos	-
	5 Polyclinic	-	nos	-
	6 Livestocks (87lit/household)	187	household	16.3
	Sub-total			80.3
	Unaccounted for water (20%)			16.1
1	Average Daily Water Demand			96.4 m3/day
2	Maximum Daily Water Demand			115.6 m3/day
3	Maximum Hourly Water Demand			15.7 m3/hr

B. WATER SUPPLY PLAN				
		Nr.	Total vol.	
	1 Water source type			
	a Spring1	1	7.0	lit/sec
	b Spring2	1	0.5	lit/sec
	c Spring3	1	1.5	lit/sec
	Total			777.6 m3/day
	2 Required reservoir volume			188 m3

C. WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit	
1	Intake			
	1m3	2	nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter	2,300	m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	200m3 capacity	1	nos	
4	Distribution pipe			
	50mm diameter	2,800	m	
	75mm diameter		m	
	90mm diameter	1,200	m	
	110mm diameter	2,600	m	
	150mm diameter	200	m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	-	nos	
6	Water meter installation	187	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	Aragatsotn	
No. 10	Arayi	JICA STUDY TEAM

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

Marz : **Aragatsotn**
No. : **10**
Name : **Arayi**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake	1m3	2	nos	367,700	735,400
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					735,400
2	Transmission Pipe	50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm	2,300	m	9,680	22,264,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					22,264,000
3	Reservoir	50m3		nos	8,363,900	
		100m3		nos	12,968,300	
		150m3		nos	18,804,500	
		200m3	1	nos	22,524,600	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					22,524,600
4	Distribution Pipe	50mm	2,800	m	5,520	15,456,000
		75mm		m	7,160	
		90mm	1,200	m	8,040	9,648,000
		110mm	2,600	m	9,680	25,168,000
		150mm	200	m	13,140	2,628,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					52,900,000
5	House Connection			nos	74,000	
6	Water Meter Installation		187	nos	80,000	14,960,000
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		2,720	m	3,600	9,792,000
Total					AMD	123,856,000
					Equivalent to USD	405,394
					Equivalent to JPY	42,769,076
					AMD	USD
Investment Cost per household			187	HH	662,332	2,168
Investment Cost per person			628	persons	197,223	646

No.11 Arteni

Information on Existing Water Sources (Aragatsotn)

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

No.11 Community Arteni
District Talin
Marz Aragatsotn

No.11 Community Arteni
District Talin
Marz Aragatsotn
Sampling date 26/Jul/2007

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	Spring	40	24	11.5	43	59	17.9	2,011	1.5	20.0	-
2	Borehole	40	17	38.8	43	45	44.1	1,234	-	-	17.5
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	Not acceptable
Notes	Arteni does not receive water from the pipeline though it was planned to supply 5l/sec. Presently the community uses borehole, which is not used for drinking purpose. Community feels well water is poor in quality. Water is brought by tank-trucks.
Alternative sources if any	No alternative water sources are available

	Parameters analysed	Units	No.1	Guidelines	
				WHO	Armenia
a	pH		8.3	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	23		
c	TDS	Mg/L	39	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	n.d	0.05	0.05
5	Cu: Copper	Mg/L	n.d	2	1
6	F: Fluoride	Mg/L	0.02	1.50	
7	Hardness	Mg/L	210	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	0.9	50.0	45.0
13	SO4: Sulfate	Mg/L	4.0	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	n.d	0.0030	0.0010
19	Pb: Lead	Mg/L	<0.001	0.010	0.030
20	Hg: Mercury	Mg/L	<0.0002	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	<9	-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml	n.d	0	0
26	Total bacteria	bacteria per 1 ml	106	-	50

No. 11 Marz Aragatsotn Community Arteni**1. ACCESSIBILITY TO THE SITE**

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

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Water main	40°24'11.5"	43°59'17.9"	2011	1956	RC	-	No
2	Groundwater	40°17'38.8"	43°45'44.1"	1234	1973	Steel	17.5	No

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	25,000	150	Steel	0	2003	Little	No

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m ³)	Rehabilitation Necessity (Y/N)
1	40°20'05.8"	43°47'19.4"	1,364	RC	Rectangular	10x10x5.5	500	No

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	12,000	150	cast iron	1975	Huge	Yes
2	3,000	100	Steel	1975	Huge	Yes
3	1,000	150	Polyethylene	2002		No
4	1,000	100	Polyethylene	2002		No
5	1,000	65	Polyethylene	2002		No

7. PUMP STATION

Existence (Y/N)	Power source	Type	Capacity (l/s)	Pump head (m)	Tank cap. (m ³)	House size (m)	Rehabilitation Necessity (Y/N)
Yes (1nos)	Commercial		-	-	-	-	No

8. PUBLIC TAPS

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

9. DRAINAGE SYSTEM

Existence	Rehabilitation	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.11 Arteni
District	Talin

No.	Question	Answer
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A: Baseline Data

A1	Actual population in 2001	3,770
A2	Actual population in 2007	3,340
A3	Number of households	750
A4.1	Elderly people	292
A4.2	Population in labor force (age from 16 to 62)	2,128
A4.3	Children	920
A5.1	Pensioners	450
A5.2	Unemployed	60
A5.3	Receiving benefits	56
A6	Average monthly income of household (AMD)	70,000
A7	Number of medical ambulance staion/first and health post	1
A8	Number of beds in each medical ambulance staion	10
A9	Number of school	2
A10	Number of pupils	670

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	13,025
	Annual Budget of the community 2005, in thousand AMD	15,309
	Annual Budget of the community 2006, in thousand AMD	19,276
	Annual Budget of the community 2007, in thousand AMD	11,754
	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:	pleins, fruit
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	absent
D6	Present condition of the water supply volume of Irrigation water	almost sufficient
D7	Number of house connection to drinking water system	600
D8	How many house connection household set the water meter	0
D9	Number of public taps	7
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?	no water at all
D11	What time of day water is given?	-
D12	Are you pleased with duration of domestic water supply?	mainly 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?	-

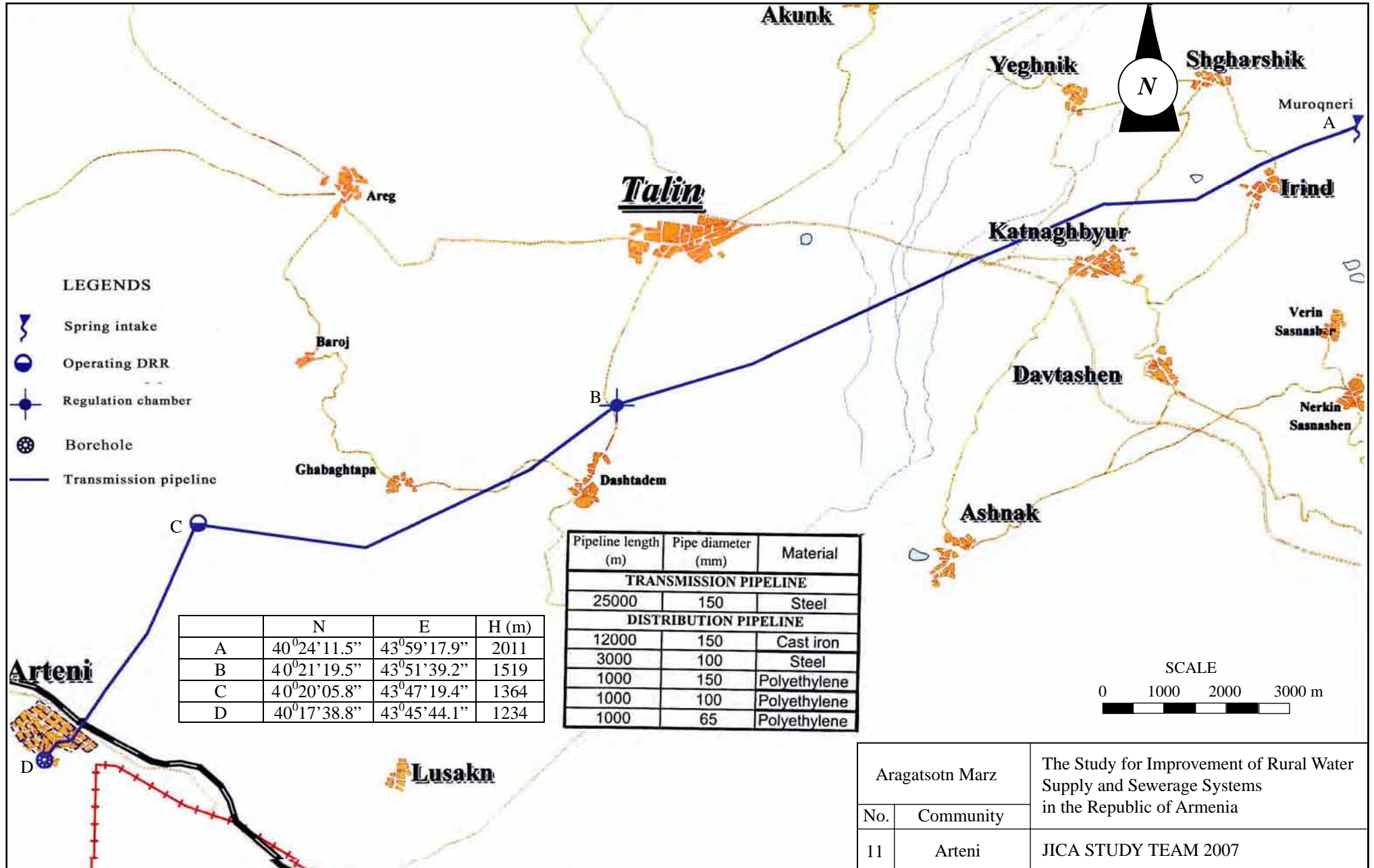
No.	Question	Answer
D14.2	Estimate quantity of domestic water use of each household (litter per day)	150
D15.1	How long the taps are open to provide the each household for filling	-
D15.2	Estimate quantity of water for filling containers of each household (litter per	400
D16	Drinking water monthly water fee per household	500drams
D17	How often do you usually pay water fees?	irregularly, when affordable
D18	Water fee structure 1Flat rate, 2 Having water tariff	flat rate
D19	Where do you acquire the irrigation water?	WUA
D20	Are you satisfied with irrigation water supply volume?	is not sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Gabrielyan Surik
E2	Position	utility department head
E3	Telephone	(093)331425
E4	Quantity and present condition of the water supply facilities: spring/ intake	absent
E5	Quantity and present condition of the water supply facilities:	1 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 pipes	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	partially repaired
E9	Quantity and present condition of the water supply facilities: pump	1 deteriorated
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 in the community with fee
E14	How you prepare O&M costs?	community budget
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	5,000,000
	Labor cost (AMD)	1,500,000
	Repair cost(AMD)	2,000,000
	Others(AMD)	0
	Total (AMD)	9,000,000
E16	Do the residents participate in the O&M works?	no
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	yes
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

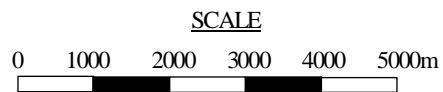
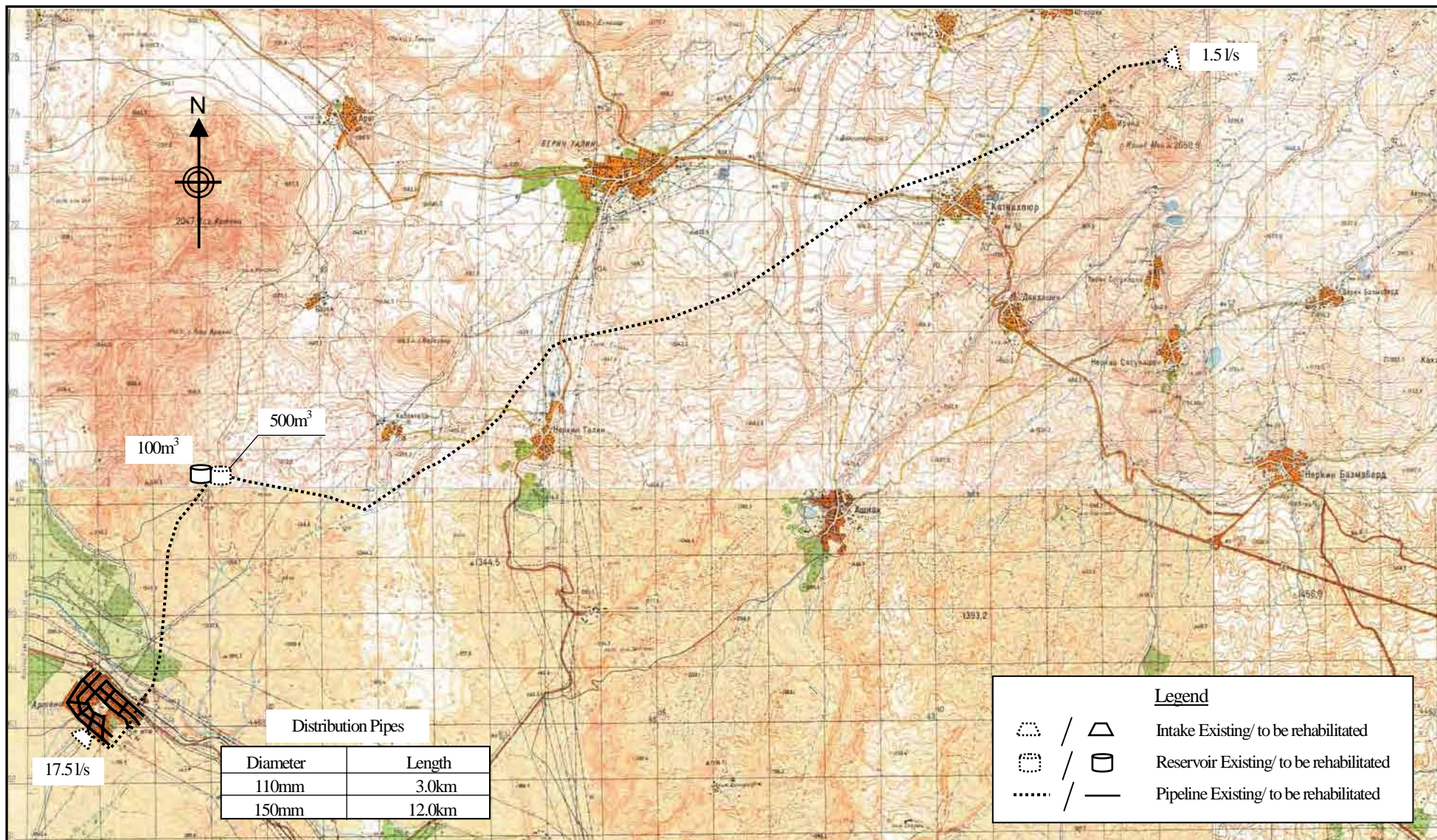


Marz : **Aragatsotn**
Name : **Arteni**

No.11

No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
	1 Population	3,340	persons	334.0
	2 Factory	-	nos	0.0
	3 School (pupils)	670	pupils	6.7
	4 Medical Ambulance Station	1	nos	1.2
	5 Polyclinic	-	nos	-
	6 Livestocks (87lit/household)	750	household	65.3
	Sub-total			407.2
	Unaccounted for water (20%)			81.4
1	Average Daily Water Demand		288.2	488.6 m3/day
2	Maximum Daily Water Demand			586.4 m3/day
3	Maximum Hourly Water Demand			50.8 m3/hr
B. WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.	
	a Borehole	1	17.5	lit/sec
	b Existing pipeline	1	1.5	lit/sec
	Total			1641.6 m3/day
	2 Required reservoir volume			610 m3

C. WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit	
1	Intake			
	1m3		nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	100m3 capacity	1	nos	
4	Distribution pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter	3,000	m	
	150mm diameter	12,000	m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	150	nos	
6	Water meter installation	750	nos	
7	Public tap	8	nos	
8	Chlorination	1	nos	
9	Pumps	-	nos	



Water Supply Facilities Rehabilitation Plan	
Marz	Aragatsotn
No. 11	Arteni

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 : **Aragatsotn**

No. : **11**

Name : **Arteni**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake	1m3		nos	367,700	
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					
2	Transmission Pipe	50mm		m	5,520	
		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					
3	Reservoir	50m3		nos	8,363,900	
		100m3	1	nos	12,968,300	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					12,968,300
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	12,000	m	13,140	157,680,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					186,720,000
5	House Connection		150	nos	74,000	11,100,000
6	Water Meter Installation		750	nos	80,000	60,000,000
7	Public Tap		8	nos	90,000	720,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage	concrete surfa	6,000	m	3,600	21,600,000
Total					AMD	293,608,300
					Equivalent to USD	961,012
					Equivalent to JPY	101,386,736
					AMD	USD
Investment Cost per household			750	HH	391,478	1,281
Investment Cost per person			3,340	persons	87,907	288

ARAGATSOTN MARZ
Talin District
No 11 Arteni

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
1 Revenue		
Water fee revenue	917.76	87.5%
Subsidy	130.89	12.5%
Total	1,048.65	100.0%
2 Expenditure		
OM cost	570.99	54.4%
Loan repayment	357.47	34.1%
Interest paid	84.25	8.0%
Surplus cash	35.94	3.4%
Total	1,048.65	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	319.61	2.30	1.64	138.42	138.48	38.18	0.33	0.26																																								
2. Operation and Maintenance Cost																																																
Salary	27.36			0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72			
Chlorine	20.52			0.23	0.49	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55			
Electricity	161.67			1.93	1.70	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39			
Maintenance cost	67.54			0.79	1.59	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81			
Pump replacement																																																
Sub-total	289.10			3.68	4.50	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47		
Total Outflow	608.71	2.30	1.64	142.10	142.98	45.65	7.80	7.73	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47	7.47		
B BENEFIT																																																
1. Water Tariff	597.87	0.00	0.00	7.05	14.10	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	16.02	
2. Subsidy	76.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.92	3.81	3.70	3.59	3.44	13.09	3.18	3.05	2.88	2.73	2.56	2.38	2.19	2.00	1.80	1.59	1.37	1.13	0.88	0.63	0.39	0.14	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 Inflow	674.15	0.00	0.00	7.05	14.10	16.02	16.02	16.02	16.02	16.02	19.94	19.83	19.72	19.61	19.46	19.11	18.90	18.75	18.58	18.40	18.21	18.02	17.82	17.61	17.39	17.15	16.90	16.65	16.40	16.15	15.90	15.65	15.40	15.15	14.90	14.65	14.40	14.15	13.90	13.65	13.40	13.15	12.90	12.65	12.40	12.15	11.90	
NET BENEFIT	65.44	-2.30	-1.64	-135.0	-128.9	-29.6	8.22	8.29	8.55	8.55	8.55	12.47	12.36	12.25	12.14	11.99	15.64	11.73	11.60	11.43	11.28	11.11	10.93	10.74	10.55	10.35	10.14	9.92	9.68	9.43	9.18	8.88	8.64	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55		
FIRR =	1.09%																																															

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	-60.49	-2.53	-1.80	-148.9	-142.7	-33.4	8.19	8.26	8.55	8.55	8.55	12.47	12.36	12.25	12.14	11.99	15.64	11.73	11.60	11.43	11.28	11.11	10.93	10.74	10.55	10.35	10.14	9.92	9.68	9.43	9.18	8.88	8.64	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55		
	2 Capital cost 20% up	-90.48	-2.76	-1.97	-162.7	-156.6	-37.3	8.15	8.24	8.55	8.55	8.55	12.47	12.36	12.25	12.14	11.99	15.64	11.73	11.60	11.43	11.28	11.11	10.93	10.74	10.55	10.35	10.14	9.92	9.68	9.43	9.18	8.88	8.64	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55	8.55
2	1 OM cost 10% up	-50.56	-2.30	-1.64	-135.4	-129.3	-30.4	7.47	7.54	7.80	7.80	7.80	11.72	11.61	11.50	11.39	11.24	14.29	10.98	10.85	10.68	10.53	10.36	10.18	9.99	9.80	9.60	9.39	9.17	8.93	8.68	8.43	8.19	7.94	7.69	7.45	7.20	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06
	2 OM cost 20% up	-70.63	-2.30	-1.64	-135.8	-129.8	-31.1	6.73	6.80	7.06	7.06	7.06	10.98	10.87	10.76	10.65	10.50	12.95	10.24	10.11	9.94	9.79	9.62	9.44	9.25	9.06	8.86	8.65	8.43	8.19	7.94	7.69	7.45	7.20	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06
3	1 Revenue 10% down	-77.51	-2.30	-1.64	-135.8	-130.3	-31.2	6.62	6.69	6.95	6.95	6.95	10.48	10.38	10.28	10.18	10.04	12.73	9.81	9.69	9.54	9.41	9.25	9.09	8.92	8.75	8.57	8.38	8.18	7.97	7.74	7.52	7.29	7.03	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	6.95	
	2 Revenue 20% down	-124.53	-2.30	-1.64	-136.5	-131.7	-32.8	5.02	5.09	5.35	5.35	5.35	8.48	8.39	8.31	8.22	8.10	9.82	7.89	7.79	7.65	7.53	7.39	7.25	7.10	6.95	6.79	6.62	6.44	6.25	6.05	5.85	5.65	5.45	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	

No.	Description	FIRR	Sensitivity indicator	Switching value
1	1 Capital cost 10% up	0.52%	10.88	9.19%
	2 Capital cost 20% up	0.02%	478.75	0.21%
2	1 OM cost 10% up	0.62%	7.45	13.42%
	2 OM cost 20% up	0.13%	71.26	1.40%
3	1 Revenue 10% down	-0.03%	-321.78	-0.31%
	2 Revenue 20% down	-1.32%	-18.21	-5.49%

No.12 Apnagyugh

Information on Existing Water Sources (Aragatsotn)

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

No.12 Community Apnagyugh
District Aparan
Marz Aragatsotn

No.12 Community Apnagyugh
District Aparan
Marz Aragatsotn
Sampling date 13/Aug/2007

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	3 springs	40	26	48.5	44	21	37.9	1,896	4.0	8.0	6.0
2	Borehole	40	27	7.8	44	23	21.5	1,825	-	-	0.0
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	The spring intake is deteriorated. Not all water is taken from the spring. The borehole is not operational.
Alternative sources if any	No alternative water sources are available

	Parameters analysed	Units	No.1 Amra aghbyur	Guidelines	
				WHO	Armenia
a	pH		7.5	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	6.9		
c	TDS	Mg/L	25	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	4	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	0.13	1.50	
7	Hardness	Mg/L	50	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	0.020	0.070	0.250
11	Ni: Nickel	Mg/L	0.007	0.020	0.100
12	Nitrate(NO3+)	Mg/L	0.9	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	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	n.d	NA	7.0
23	CN: Cyanide	Mg/L	n.d	0.070	0.035
24	Coli form bacteria	bacteria per 100 ml	n.d	-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml	n.d	0	0
26	Total bacteria	bacteria per 1 ml	n.d	-	50

No. 12 Marz Aragatsotn Community Apnagyugh**1. ACCESSIBILITY TO THE SITE**

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

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Water main	40°26'48.5"	44°21'37.9"	1,896	1952	Concrete	6.0	Yes
2	Groundwater	40°27'07.8"	44°23'21.5"	1,825	2001	Steel	-	No

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	3300	125	Steel	3.8	2004	Little	No
	200	150	Steel		2004	Little	No
2	700	100	Steel	0.0	2004	Little	No

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°26'45.6"	44°23'31.5"	1,832	reinforced concrete	Rectangular	6x12x4	250	No

5. CHLORINATION

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	No	Reservoir	Powder	twice per month

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	1,250	50	Steel	1976	Little	Yes
2	600	80	Steel	1976	Little	Yes
3	1,300	100	Steel	1976	Little	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)
15	1976	1998	Yes	0	Yes

9. DRAINAGE SYSTEM

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.12 Apnagyugh
District	Aparan

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

A: Baseline Data

A1	Actual population in 2001	560
A2	Actual population in 2007	705
A3	Number of households	140
A4.1	Elderly people	85
A4.2	Population in labor force (age from 16 to 62)	575
A4.3	Children	145
A5.1	Pensioners	92
A5.2	Unemployed	16
A5.3	Receiving benefits	15
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	90

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	1,920
	Annual Budget of the community 2005, in thousand AMD	3,600
	Annual Budget of the community 2006, in thousand AMD	3,607
	Annual Budget of the community 2007, in thousand AMD	594
	Annual Budget of the community 2008, in thousand AMD	is not planned.
B2	Amount spent in drinking water sector 2004, in thousand AMD	95
	Amount spent in drinking water sector 2005, in thousand AMD	110
	Amount spent in drinking water sector 2006, in thousand AMD	130
	Amount spent in drinking water sector 2007, in thousand AMD	150
	Amount spent in drinking water sector 2008, in thousand AMD	200

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	2007
D5	Present condition of the water supply volume of Domestic use	sufficient
D6	Present condition of the water supply volume of Irrigation water	insufficient
D7	Number of house connection to drinking water system	140
D8	How many house connection household set the water meter	0
D9	Number of public taps	10
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?	very 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)	200
	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	600
	D16	Drinking water monthly water fee per household	0
	D17	How often do you usually pay water fees?	-
	D18	Water fee structure 1-Flat rate, 2 Having water tariff	-
	D19	Where do you acquire the irrigation water?	spring
	D20	Are you satisfied with irrigation water supply volume?	is not sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Karapetyan Robert
E2	Position	administration head
E3	Telephone	(093)251403
E4	Quantity and present condition of the water supply facilities: spring/ intake	1 deteriorated
E5	Quantity and present condition of the water supply facilities:	1 partially repaired
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 pipes	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	1 rehabilitated.
E10	Who is the owner of the water supply facilities?	community
E11	Who is engaged in the water supply facilities repairing works?	residents
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?	community budget
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	150,000
	Others(AMD)	0
	Total (AMD)	150,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	resident participation

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	yes
F1.3	Ecological improvement habits areas (coral reef, mangrove wetland, tidal	yes
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	yes
F1.8	Living areas of ethic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent



Arayi

	N	E	H (m)
A	40°26'48.5"	44°21'37.9"	1896
B	40°26'45.6"	44°23'31.5"	1832
C	40°27'07.8"	44°23'21.5"	1825



Amra

A

C






2

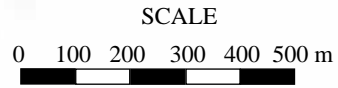
B

Apnagyugh

Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
1. 3500		
3300	125	Steel
200	150	
2. 700		
700	100	Steel
DISTRIBUTION PIPELINE		
1250	50	Steel
600	80	
1300	100	

LEGENDS

-  Spring intake
-  Operating DRR
-  Borehole
-  Transmission pipeline
-  Distribution pipeline



Aragatsotn Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
12	Apnagyugh	JICA STUDY TEAM 2007

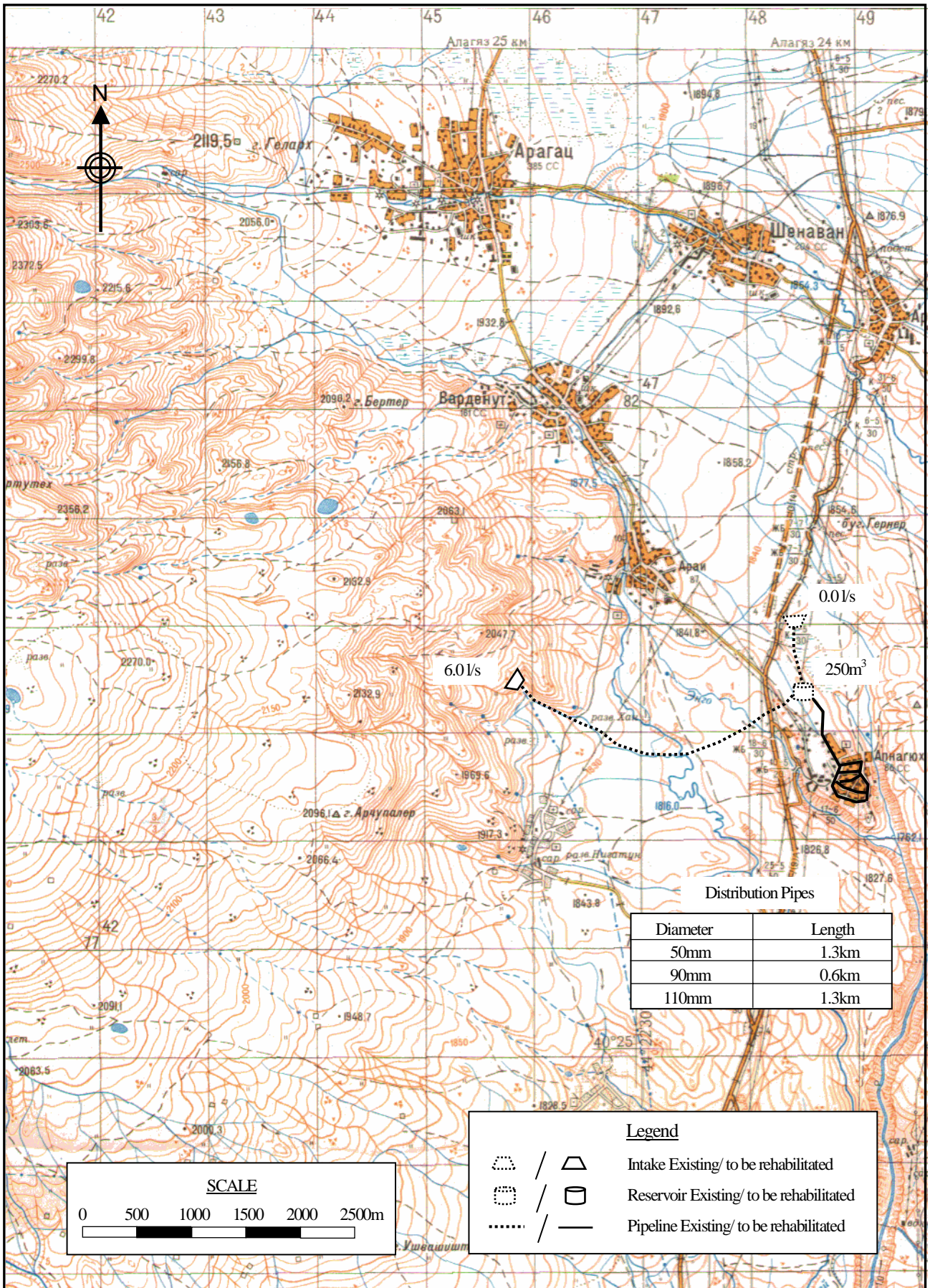
Marz : **Aragatsotn**
Name : **Apnagyugh**

No.12

No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
	1 Population	705	persons	70.5
	2 Factory	-	nos	0.0
	3 School (pupils)	90	pupils	0.9
	4 Medical Ambulance Station	-	nos	-
	5 Polyclinic	-	nos	-
	6 Livestocks (87lit/household)	140	household	12.2
	Sub-total			83.6
	Unaccounted for water (20%)			16.7
1	Average Daily Water Demand			100.3 m3/day
2	Maximum Daily Water Demand			120.4 m3/day
3	Maximum Hourly Water Demand			16.3 m3/hr
B. WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.	
	a Spring	1	6.0 lit/sec	518.4 m3/day
	b Borehole	1	0 lit/sec	
	Total			518.4 m3/day
	2 Required reservoir volume			196 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		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
4	Distribution pipe			Done by pilot project
	50mm diameter	1,300	m	
	75mm diameter		m	
	90mm diameter	600	m	
	110mm diameter	1,300	m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	-	nos	Done by pilot project
6	Water meter installation	-	nos	"
7	Public tap	-	nos	"
8	Chlorination	-	nos	"
9	Pumps	-	nos	



6.0l/s

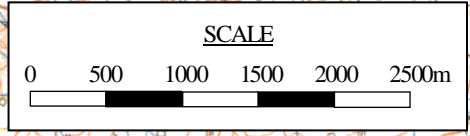
0.0l/s

250m³

Distribution Pipes

Diameter	Length
50mm	1.3km
90mm	0.6km
110mm	1.3km

Legend	
	Intake Existing/ to be rehabilitated
	Reservoir Existing/ to be rehabilitated
	Pipeline Existing/ to be rehabilitated



Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Aragatsotn	
No. 12	Anagnugh	JICA STUDY TEAM

Marz : **Aragatsotn**
No. : **12**
Name : **Apnagyugh**

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		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					
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		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3		nos	42,520,900	
	Sub-total					
4	Distribution Pipe	50mm	1,300	m	5,520	7,176,000
		75mm		m	7,160	
		90mm	600	m	8,040	4,824,000
		110mm	1,300	m	9,680	12,584,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					24,584,000
5	House Connection			nos	74,000	
6	Water Meter Installation			nos	80,000	
7	Public Tap			nos	90,000	
8	Chlorilation Equipment			nos	500,000	
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa		1,280	m	3,600	4,608,000
Total					AMD	29,559,700
					Equivalent to USD	96,752
					Equivalent to JPY	10,207,346
					AMD	USD
	Investment Cost per household		140	HH	211,141	691
	Investment Cost per person		705	persons	41,929	137

No.13 Baysz

Information on Existing Water Sources (Aragatsotn)

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

No.13 Community Baysz
District Talin
Marz Aragatsotn

No.13 Community Baysz
District Talin
Marz Aragatsotn
Sampling date 16/Aug/2007

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	Spring	40	23	55.7	44	4	41.9	2,337	1.5	4.0	2.0
2	Spring	40	23	38.9	44	4	50.8	2,245	2.0	5.0	2.5
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 Acceptance for water quality	Acceptable
Notes	Discharge of these springs is divided between "No.13 Bayaz" and "No.21 Dian" communities, with 1.5l/sec and 3l/sec flow accordingly. The community has not the internal network. Population uses 5 public taps.
Alternative sources if any	Community Baysz has also 2 prospective springs with 2.5l/sec and 2 l/sec discharges, which currently are used for irrigation.

	Parameters analysed	Units	No.1	Guidelines	
				WHO	Armenia
a	pH		7.3	6.5-8	6.0 - 9.0
b	Temperature	Deg.C	17.6		
c	TDS	Mg/L	32	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	4	250	350
4	Cr:Chrome	Mg/L	n.d	0.05	0.05
5	Cu:Copper	Mg/L	n.d	2	1
6	F:Fluoride	Mg/L	0.06	1.50	
7	Hardness	Mg/L	70	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	n.d	0.020	0.100
12	Nitrate(NO3+)	Mg/L	1.8	50.0	45.0
13	SO4:Sulfate	Mg/L	4.0	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	0.0001	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

No. 13 Marz Aragatsotn Community Baysz**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	Fair	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°23'55.7"	44°04'41.9"	2,337	1970	reinforced concrete	2.0	Yes
2	Spring	40°23'38.9"	44°04'50.8"	2,245	1970	reinforced concrete	2.5	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	900	65	Steel	1.8	1975	Little	Yes
2	600	100	Steel	2.25	1975	Little	Yes
3	2,950	50	Steel	1.0	1975	Medium	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°22'07.9"	44°03'40.2"	1882	reinforced concrete	Rectangular	3x4x3	25	Yes

5. CHLORINATION EQUIPMENT

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	Yes	Reservoir	Powder	once a week

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	700	50	Steel	1970	Medium	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	1970	1980	Yes	80	Yes

9. DRAINAGE SYSTEM

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.13 Baysz
District	Talin

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

A: Baseline Data

A1	Actual population in 2001	350
A2	Actual population in 2007	260
A3	Number of households	60
A4.1	Elderly people	25
A4.2	Population in labor force (age from 16 to 62)	205
A4.3	Children	30
A5.1	Pensioners	16
A5.2	Unemployed	0
A5.3	Receiving benefits	2
A6	Average monthly income of household (AMD)	15,000
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	26

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	220
	Annual Budget of the community 2005, in thousand AMD	260
	Annual Budget of the community 2006, in thousand AMD	300
	Annual Budget of the community 2007, in thousand AMD	200
	Annual Budget of the community 2008, in thousand AMD	is not planned.
B2	Amount spent in drinking water sector 2004, in thousand AMD	500
	Amount spent in drinking water sector 2005, in thousand AMD	600
	Amount spent in drinking water sector 2006, in thousand AMD	600
	Amount spent in drinking water sector 2007, in thousand AMD	300
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned.

C: Socio-Economic Survey

C1	Major industries of the community:	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	yes
D2	Water use permit number	1220
D3	Date of expiry of water use permit	02.11.09-02.11.12
D4	Planned date of obtaining water use permit	-
D5	Present condition of the water supply volume of Domestic use	insufficient
D6	Present condition of the water supply volume of Irrigation water	almost sufficient
D7	Number of house connection to drinking water system	0
D8	How many house connection household set the water meter	0
D9	Number of public taps	3
D10.1	How is the regime of water supply in your community in the dry season?	in winter, there is 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?	mainly displeased
D13	Are hours of water supply convenient?	mainly 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?	-

No.	Question	Answer
D14.2	Estimate quantity of domestic water use of each household (litter per day)	400
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 1-Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	spring
D20	Are you satisfied with irrigation water supply volume?	almost sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Fatoyan Bro
E2	Position	Administration head
E3	Telephone	93369771
E4	Quantity and present condition of the water supply facilities: spring/ intake	3- deteriorated
E5	Quantity and present condition of the water supply facilities:	1- partially repaired
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	1- deteriorated
E7	Quantity and present condition of the water supply facilities: net/distribution pipes	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 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?	residents
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	0
	Repair cost(AMD)	600,000
	Others(AMD)	0
	Total (AMD)	600,000
E16	Do the residents participate in the O&M works?	manpower
E17	What kind of OM method is preferable to you?	as manpower , reduce water








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	present

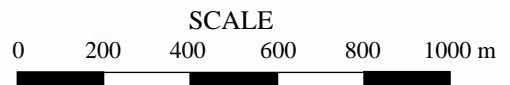


Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
1. 900	65	Steel
2. 600	100	
3. 2950	50	
DISTRIBUTION PIPELINE		
700	50	Steel

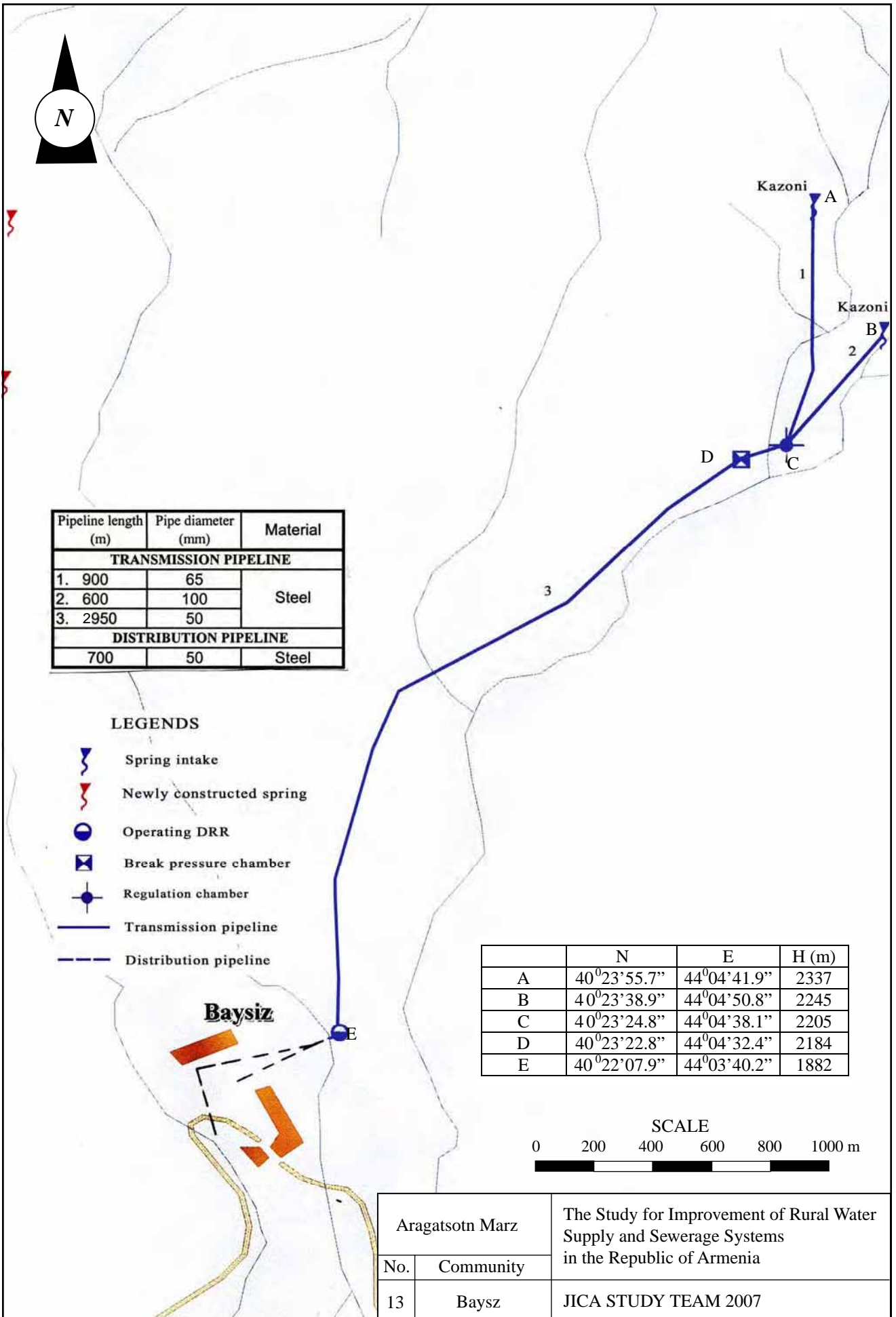
LEGENDS

-  Spring intake
-  Newly constructed spring
-  Operating DRR
-  Break pressure chamber
-  Regulation chamber
-  Transmission pipeline
-  Distribution pipeline

	N	E	H (m)
A	40°23'55.7"	44°04'41.9"	2337
B	40°23'38.9"	44°04'50.8"	2245
C	40°23'24.8"	44°04'38.1"	2205
D	40°23'22.8"	44°04'32.4"	2184
E	40°22'07.9"	44°03'40.2"	1882



Aragatsotn Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
13	Baysz	JICA STUDY TEAM 2007

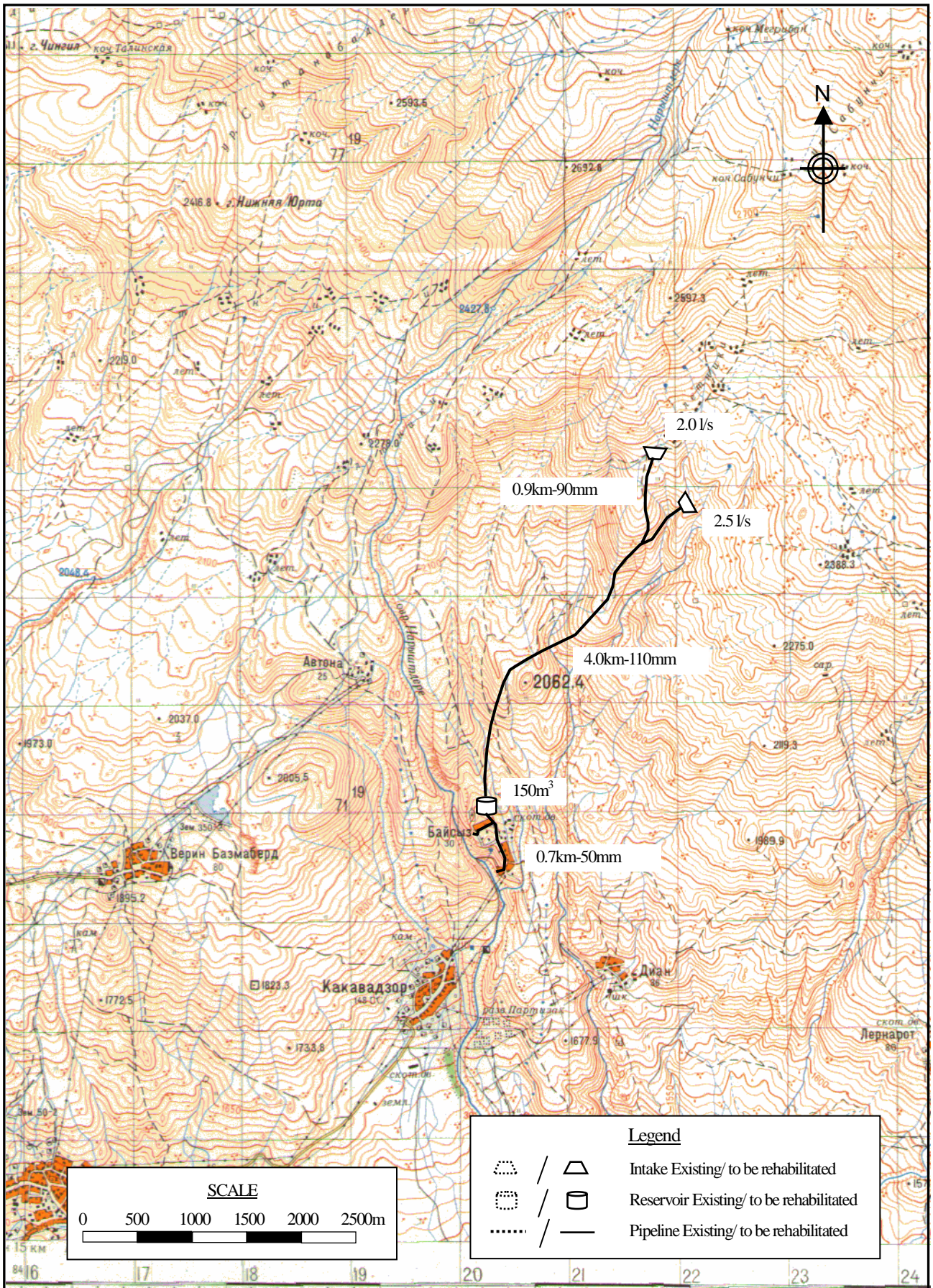


Marz : **Aragatsotn**
Name : **Baysz**

No.13

No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
	1 Population	260	persons	26.0
	2 Factory	-	nos	0.0
	3 School (pupils)	26	pupils	0.3
	4 Medical Ambulance Station	-	nos	-
	5 Polyclinic	-	nos	-
	6 Livestocks (87lit/household)	60	household	5.2
	Sub-total			31.5
	Unaccounted for water (20%)			6.3
1	Average Daily Water Demand			37.8 m3/day
2	Maximum Daily Water Demand			45.4 m3/day
3	Maximum Hourly Water Demand			9.8 m3/hr
B. WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.	
	a Spring	2	4.5 lit/sec	388.8 m3/day
	Total			388.8 m3/day
	2 Required reservoir volume			118 m3

C. WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit	
1	Intake			
	1m3	2	nos	
	2m3		nos	
	3m3		nos	
	4m3		nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter	900	m	
	110mm diameter	4,000	m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	150m3 capacity	1	nos	
4	Distribution pipe			
	50mm diameter	700	m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	60	nos	
6	Water meter installation	60	nos	
7	Public tap	1	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	Aragatsotn	
No. 13	Baysz	JICA STUDY TEAM

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

Marz : **Aragatsotn**

No. : **13**

Name : **Baysz**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake	1m3	2	nos	367,700	735,400
		2m3		nos	545,000	
		3m3		nos	669,100	
		4m3		nos	805,100	
	Sub-total					735,400
2	Transmission Pipe	50mm		m	5,520	
		75mm		m	7,160	
		90mm	900	m	8,040	7,236,000
		110mm	4,000	m	9,680	38,720,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					45,956,000
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	700	m	5,520	3,864,000
		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					3,864,000
5	House Connection		60	nos	74,000	4,440,000
6	Water Meter Installation		60	nos	80,000	4,800,000
7	Public Tap		1	nos	90,000	90,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage concrete surfa		280	m	3,600	1,008,000
Total					AMD	80,197,900
					Equivalent to USD	262,496
					Equivalent to JPY	27,693,370
					AMD	USD
Investment Cost per household			60	HH	1,336,632	4,375
Investment Cost per person			260	persons	308,453	1,010

No.14 Byurakan

Information on Existing Water Sources (Aragatsotn)

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

No.14 Community Byurakan
District Ashtarak
Marz Aragatsotn

No.14 Community Byurakan
District Ashtarak
Marz Aragatsotn
Sampling date 04/Sep/2007

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	River (Aragats intake)	40	27	43.0	44	9	31.8	2,657	12	25	15.0
2	River	40	27	32.6	44	9	33.2	2,618	-	55	55.0
3	River (Oagoy intake)	40	22	20.5	44	14	41.8	1,710	10	25	16.5
4	Borehole	40	20	39.3	44	16	43.9	1,536	-	-	0.0
5	Borehole	40	20	31.3	44	16	46.1	1,514	-	-	0.0
6											
7											
8											
9											
10											

Notes:

<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	Not acceptable
Notes	Boreholes do not operate currently. River water is not suitable for drinking purposes.
Alternative sources if any	Byurakan community has not big water store (no big groundwater development potential).

	Parameters analysed	Units	No.1	No.2	Guidelines	
					WHO	Armenia
<i>a</i>	pH		7.7	7.5	6.5-8	6.0 - 9.0
<i>b</i>	Temperature	Deg.C	17.2	15		
<i>c</i>	TDS	Mg/L	31	47	1000	1000
1	Al:Aluminum	Mg/L	0.01	n.d	0.10	0.50
2	B:Boron	Mg/L	n.d	n.d	0.70	0.50
3	Cl:Chloride	Mg/L	4	6	250	350
4	Cr:Chrome	Mg/L	<0.01	<0.01	0.05	0.05
5	Cu:Copper	Mg/L	n.d	n.d	2	1
6	F:Fluoride	Mg/L	0.08	0.16	1.50	
7	Hardness	Mg/L	45	80	500	700
8	Fe:Iron	Mg/L	0.06	0.04	0.30	0.30
9	Mn:Manganese	Mg/L	n.d	n.d	0.40	0.10
10	Mo:Molibdenum	Mg/L	<0.02	n.d	0.070	0.250
11	Ni:Nickel	Mg/L	n.d	n.d	0.020	0.100
12	Nitrate(NO3+)	Mg/L	1.3	0.5	50.0	45.0
13	SO4:Sulfate	Mg/L	2.0	4.0	250.0	500.0
14	Zn:Zink	Mg/L	n.d	n.d	3.0	5.0
15	As:Arsenic	Mg/L	n.d	n.d	0.0	0.1
16	Ba:Barium	Mg/L	<0.01	<0.01	0.70	0.10
17	Be:Berillium	Mg/L	n.d	n.d	NA	0.00020
18	Cd:Cadmium	Mg/L	0.0001	<0.0001	0.0030	0.0010
19	Pb:Lead	Mg/L	0.001	<0.001	0.010	0.030
20	Hg:Mercury	Mg/L	n.d	n.d	0.00100	0.00050
21	Se:Selenium	Mg/L	<0.001	<0.001	0.010	0.010
22	Sr:Strontium	Mg/L	n.d	n.d	NA	7.0
23	CN:Cyanide	Mg/L	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

No. 14 Marz Aragatsotn Community Byurakan**1. ACCESSIBILITY TO THE SITE**

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

2. INTAKE STRUCTURE

No.	Water main	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°27'43.0"	44°09'31.8"	2,657	1997	Concrete	15.0	Yes
2	River/stream	40°27'32.6"	44°09'33.2"	2,618	1985	Concrete	55.0	Yes
3	Spring	40°22'20.5"	44°14'41.8"	1,710	1950	Concrete	16.5	Yes
4	Groundwater	40°20'39.3"	44°16'43.9"	1,536	-	-	-	No
5	Groundwater	40°20'31.3"	44°16'46.1"	1,514	-	-	-	No

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	2,000	200	Steel	13.5	1997	Little	Yes
	400	300					
2	9,000	300	Steel	30.0	1997	Little	Yes
	23,000	150					
	2,000	200					
3	3,500	150	Steel	7.6	1970	Little	Yes

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°21'00.8"	44°16'01.5"	1,612	reinforced concrete	Rectangular	8x10x6	400	Yes
2	40°21'03.9"	44°16'01.7"	1,609	reinforced concrete	Rectangular	6x8x4	150	Yes

5. CHLORINATION

No.	Existence (Y/N)	Location	Chlorine type	Chlorine duration
1	Yes	Reservoir	Powder	once in 2days

6. DISTRIBUTION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Year	Leakage	Rehabilitation Necessity (Y/N)
1	2,400	150	Steel	1950	Little	Yes
2	6,500	100	Steel		Little	Yes
3	1,150	50	Steel		Little	Yes
4	400	100	Ductile Iron		Little	Yes
5	4,000	50	Polyethylene	2000	Little	No

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)
22	1950	1996	No	0	Yes

9. DRAINAGE SYSTEM

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.14 Byurakan
District	Ashtarak

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

A: Baseline Data

A1	Actual population in 2001	4,950
A2	Actual population in 2007	4,950
A3	Number of households	1,850
A4.1	Elderly people	620
A4.2	Population in labor force (age from 16 to 62)	3,417
A4.3	Children	909
A5.1	Pensioners	800
A5.2	Unemployed	1,154
A5.3	Receiving benefits	180
A6	Average monthly income of household (AMD)	25,000
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	2
A10	Number of pupils	880

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	5,479
	Annual Budget of the community 2005, in thousand AMD	11,559
	Annual Budget of the community 2006, in thousand AMD	12,896
	Annual Budget of the community 2007, in thousand AMD	15,000
	Annual Budget of the community 2008, in thousand AMD	is not planned.
B2	Amount spent in drinking water sector 2004, in thousand AMD	1,500
	Amount spent in drinking water sector 2005, in thousand AMD	1,500
	Amount spent in drinking water sector 2006, in thousand AMD	2,000
	Amount spent in drinking water sector 2007, in thousand AMD	5,000
	Amount spent in drinking water sector 2008, in thousand AMD	15,000

C: Socio-Economic Survey

C1	Major industries of the community:	dairy, meat, vegetables
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	yes
D2	Water use permit number	0441
D3	Date of expiry of water use permit	16.08.04-16.08.07
D4	Planned date of obtaining water use permit	
D5	Present condition of the water supply volume of Domestic use	1- sufficient
D6	Present condition of the water supply volume of Irrigation water	3-insufficient
D7	Number of house connection to drinking water system	950
D8	How many house connection household set the water meter	0
D9	Number of public taps	21
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?	-

No.	Question	Answer
D14.2	Estimate quantity of domestic water use of each household (litter per day)	according to the supplied
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	according to the supplied
D16	Drinking water monthly water fee per household	0
D17	How often do you usually pay water fees?	-
D18	Water fee structure 1-Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	WUA
D20	Are you satisfied with irrigation water supply volume?	almost sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	Soghomonyan Avetik
E2	Position	administration deputy head
E3	Telephone	93763778
E4	Quantity and present condition of the water supply facilities: spring/ intake	2- deteriorated
E5	Quantity and present condition of the water supply facilities:	22.5km partially repaired
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	2- partially repaired
E7	Quantity and present condition of the water supply facilities: net/distribution pipes	deteriorated
E8	Quantity and present condition of the water supply facilities: public tap	partially repaired
E9	Quantity and present condition of the water supply facilities: pump	2- deteriorated , partially repaired
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?	inviting a specialist
E13	Who is in charge of the repair work in the community?	specialist in the community with fee
E14	How you prepare O&M costs?	no collection
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	20,000
	Repair cost(AMD)	50,000
	Others(AMD)	0
	Total (AMD)	70,000
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	present
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



Aragatsi
A
B

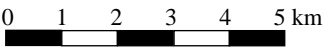
	N	E	H (m)
A	40 ⁰ 27'43.0"	44 ⁰ 09'31.8"	2657
B	40 ⁰ 27'32.6"	44 ⁰ 09'33.2"	2618
C	40 ⁰ 21'00.8"	44 ⁰ 16'01.5"	1612
D	40 ⁰ 21'03.9"	44 ⁰ 16'01.7"	1609
E	40 ⁰ 22'20.5"	44 ⁰ 14'41.8"	1710

Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
1. 2400		
2000	200	Steel
400	300	
2. 32000		
9000	300	Steel
23000	150	
2000	200	
3. 3500		
3500	150	Steel
DISTRIBUTION PIPELINE		
2400	150	Steel
6500	100	
1150	50	
400	100	Cast iron
4000	50	Polyethylene

LEGENDS

- Spring intake
- Operating DRR
- Borehole
- River intake
- Regulation chamber
- Transmission pipeline
- Distribution pipeline

SCALE



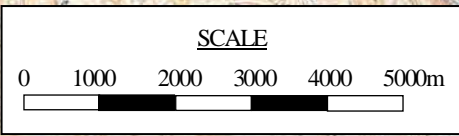
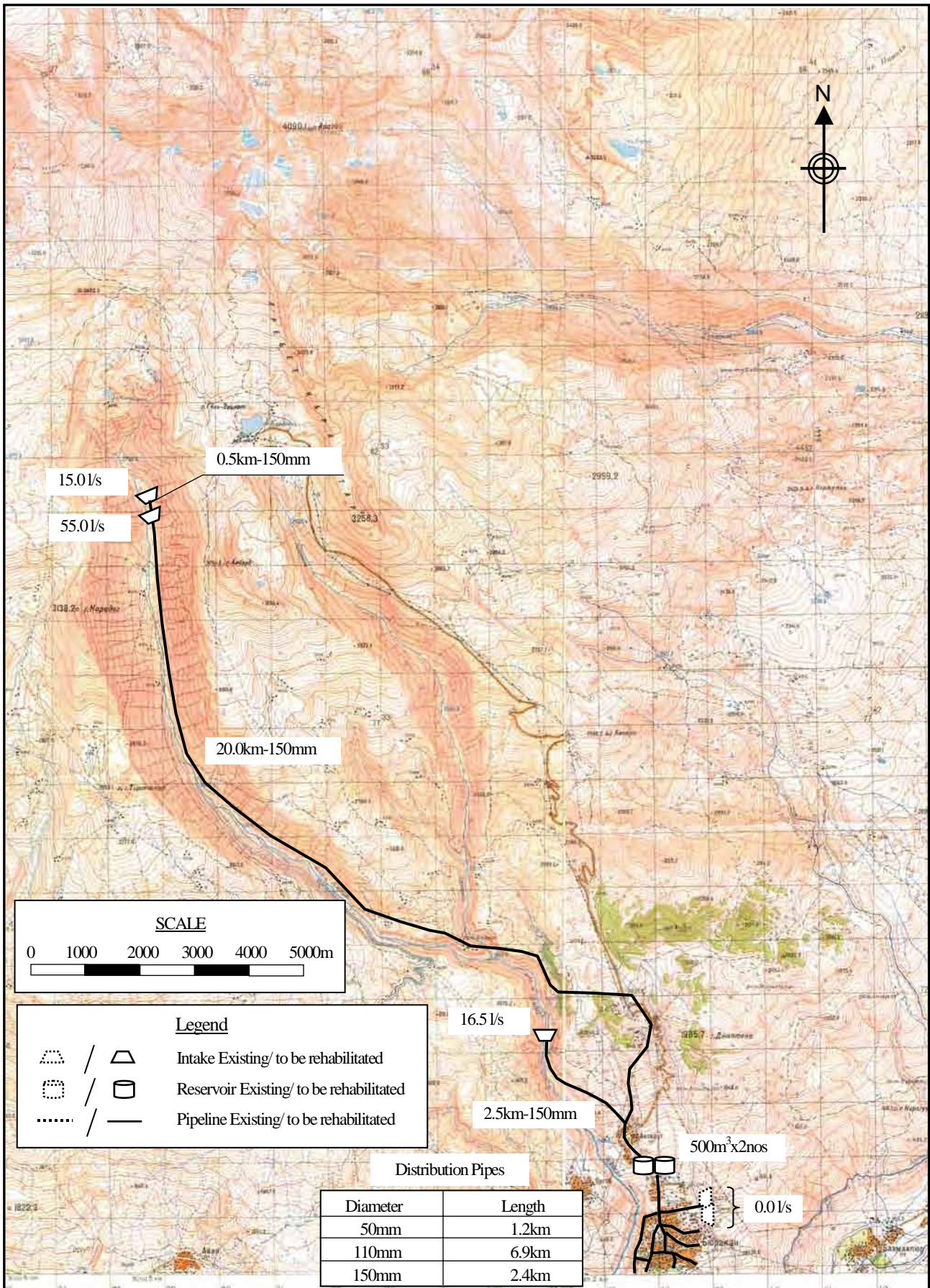
Aragatsotn Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
14	Byurakan	JICA STUDY TEAM 2007

Marz : **Aragatsotn**
Name : **Byurakan**

No.14

No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
	1 Population	4,950	persons	495.0
	2 Factory	-	nos	0.0
	3 School (pupils)	880	pupils	8.8
	4 Medical Ambulance Station	-	nos	-
	5 Polyclinic	-	nos	-
	6 Livestocks (87lit/household)	1,850	household	161.0
	Sub-total			664.8
	Unaccounted for water (20%)			133.0
1	Average Daily Water Demand			797.8 m3/day
2	Maximum Daily Water Demand			957.3 m3/day
3	Maximum Hourly Water Demand			77.8 m3/hr
B. WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.	
	a Spring/River	3	86.5	lit/sec
	b Borehole	2	0	lit/sec
	Total			7473.6 m3/day
	2 Required reservoir volume			933 m3

C. WATER SUPPLY FACILITIES REHABILITATION PLAN				
No	Item	Quantity	Unit	
1	Intake			
	1m3		nos	
	2m3	2	nos	
	3m3		nos	
	4m3	1	nos	
2	Transmission pipe			
	50mm diameter		m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter		m	
	150mm diameter	23,000	m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	500m3 capacity	2	nos	
4	Distribution pipe			
	50mm diameter	1,200	m	
	75mm diameter		m	
	90mm diameter		m	
	110mm diameter	6,900	m	
	150mm diameter	2,400	m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	900	nos	
6	Water meter installation	1,850	nos	
7	Public tap	19	nos	
8	Chlorination	1	nos	
9	Pumps	-	nos	



Legend

	/		Intake Existing/ to be rehabilitated
	/		Reservoir Existing/ to be rehabilitated
	/		Pipeline Existing/ to be rehabilitated

Distribution Pipes

Diameter	Length
50mm	1.2km
110mm	6.9km
150mm	2.4km

Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Aragatsotn	
No. 14	Byurakan	JICA STUDY TEAM

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

Marz : **Aragatsotn**
No. : **14**
Name : **Byurakan**

No	Item	Specification	Quantity	Unit	Unit Price	Total
1	Intake	1m3		nos	367,700	
		2m3	2	nos	545,000	1,090,000
		3m3		nos	669,100	
		4m3	1	nos	805,100	805,100
	Sub-total					1,895,100
2	Transmission Pipe	50mm		m	5,520	
		75mm		m	7,160	
		90mm		m	8,040	
		110mm		m	9,680	
		150mm	23,000	m	13,140	302,220,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					302,220,000
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		nos	36,388,000	
		450m3		nos	39,392,500	
		500m3	2	nos	42,520,900	85,041,800
	Sub-total					85,041,800
4	Distribution Pipe	50mm	1,200	m	5,520	6,624,000
		75mm		m	7,160	
		90mm		m	8,040	
		110mm	6,900	m	9,680	66,792,000
		150mm	2,400	m	13,140	31,536,000
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					104,952,000
5	House Connection		900	nos	74,000	66,600,000
6	Water Meter Installation		1,850	nos	80,000	148,000,000
7	Public Tap		19	nos	90,000	1,710,000
8	Chlorilation Equipment		1	nos	500,000	500,000
9	Pump Replacement			nos	10,000,000	
10	Drainage and Sewerage	concrete surfa	4,200	m	3,600	15,120,000
Total					AMD	726,038,900
					Equivalent to USD	2,376,404
					Equivalent to JPY	250,710,605
					AMD	USD
Investment Cost per household			1,850	HH	392,453	1,285
Investment Cost per person			4,950	persons	146,675	480

ARAGATSO TN MARZ
Talin District
No 14 Byurakan

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS

Item	Million AMD	Rate
1 Revenue		
Water fee revenue	1,355.27	91.2%
Subsidy	130.79	8.8%
Total	1,486.06	100.0%
2 Expenditure		
OM cost	273.47	18.4%
Loan repayment	869.24	58.5%
Interest paid	204.75	13.8%
Surplus cash	138.60	9.3%
Total	1,486.06	100.0%

B. FIRR CALCULATION

Description	Total	Year																																							Unit: million AMD								
		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	776.40	2.30	1.64	339.17	339.58	93.12	0.33	0.26																																									
2. Operation and Maintenance Cost																																																	
Salary	36.48			0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96						
Chlorine	33.57			0.38	0.79	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90					
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	0.00	0.00	0.00				
Maintenance cost	70.91			0.84	1.67	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90				
Pump replacement																																																	
Sub-total	140.96			2.18	3.42	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76			
Total Outflow	917.36	2.30	1.64	341.35	343.00	96.88	4.09	4.02	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76			
B BENEFIT																																																	
1. Water Tariff	851.33	0.00	0.00	3.84	7.69	8.74	9.02	15.29	15.79	16.31	16.85	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26		
2. Subsidy	24.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.56	4.15	3.71	3.25	2.76	2.24	1.72	1.16	0.58	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 Inflow	875.46	0.00	0.00	3.84	7.69	8.74	9.02	15.29	15.79	16.31	16.85	29.82	29.41	28.97	28.51	28.02	27.50	26.98	26.42	25.84	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26		
NET BENEFIT	-41.90	-2.30	-1.64	-337.5	-335.3	-88.1	4.93	11.27	12.03	12.55	13.09	26.06	25.65	25.21	24.75	24.26	23.74	23.22	22.66	22.08	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50			
FIRR =	-0.28%																																																

C. SENSITIVITY ANALYSIS

No.	Description	PV I.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	-305.99	-2.53	-1.80	-371.4	-369.3	-97.5	4.90	11.24	12.03	12.55	13.09	26.06	25.65	25.21	24.75	24.26	23.74	23.22	22.66	22.08	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50			
	2 Capital cost 20% up	-378.84	-2.76	-1.97	-405.3	-403.2	-106.8	4.86	11.22	12.03	12.55	13.09	26.06	25.65	25.21	24.75	24.26	23.74	23.22	22.66	22.08	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	
2	1 OM cost 10% up	-242.97	-2.30	-1.64	-337.7	-335.7	-88.5	4.55	10.89	11.65	12.17	12.71	25.68	25.27	24.83	24.37	23.88	23.36	22.84	22.28	21.70	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12	21.12
	2 OM cost 20% up	-252.81	-2.30	-1.64	-337.9	-336.0	-88.9	4.18	10.52	11.28	11.80	12.34	25.31	24.90	24.46	24.00	23.51	22.99	22.47	21.91	21.33	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75	20.75
3	1 Revenue 10% down	-292.51	-2.30	-1.64	-337.9	-336.1	-89.0	4.03	9.74	10.45	10.92	11.41	23.08	22.71	22.31	21.90	21.46	20.99	20.52	20.02	19.50	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97	18.97
	2 Revenue 20% down	-351.89	-2.30	-1.64	-338.3	-336.9	-89.9	3.13	8.21	8.87	9.29	9.72	20.10	19.77	19.42	19.05	18.66	18.24	17.82	17.38	16.91	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45	16.45

No.	Description	FIRR	Sensitivity indicator	Swiching value
1	1 Capital cost 10% up	-0.74%	-6.27	-15.95%
	2 Capital cost 20% up	-1.16%	-7.61	-13.15%
2	1 OM cost 10% up	-0.37%	-2.56	-39.13%
	2 OM cost 20% up	-0.47%	-4.08	-24.49%
3	1 Revenue 10% down	-0.89%	-6.90	-14.50%
	2 Revenue 20% down	-1.57%	-8.24	-12.14%

No.15 Garnahovit

Information on Existing Water Sources (Aragatsotn)

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

No.15 Community Garnahovit
District Talin
Marz Aragatsotn

No.15 Community Garnahovit
District Talin
Marz Aragatsotn
Sampling date 11/Sep/2007

No	Water source	Latitude			Longitude			Atitude (m)	Yield(L/sec)		
		deg	min	sec	deg	min	sec		Min	Max	At site
1	Ashot spring	40	29	56.9	43	58	54.4	2,339	6	15	4.0
2	Maralov spring	40	29	57.5	43	58	6.4	2,242	0.5	1.5	0.8
3	Khdoysi spring	40	30	2.3	43	58	3.3	2,241	0.8	2	1.0
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	Spring intakes are in deteriorated conditions, there are leakages observed.
Alternative sources if any	At 1km distance from Ashot spring there are 20 springs, with total discharge of 10l/sec.

	Parameters analysed	Units	No.1 Ashoti aghbyur	Guidelines	
				WHO	Armenia
<i>a</i>	pH		7.6	6.5-8	6.0 - 9.0
<i>b</i>	Temperature	Deg.C	8.2		
<i>c</i>	TDS	Mg/L	35	1000	1000
1	Al:Aluminum	Mg/L	0.02	0.10	0.50
2	B:Boron	Mg/L	n.d	0.70	0.50
3	Cl:Chloride	Mg/L	4	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	0.11	1.50	
7	Hardness	Mg/L	75	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	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	n.d	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	<0.0002	0.00100	0.00050
21	Se:Selenium	Mg/L	<0.001	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	>1100	-	0
25	Thermo-tolerant coli form bacteria	bacteria per 100 ml	n.d	0	0
26	Total bacteria	bacteria per 1 ml		-	50

No. 15 Marz Aragatsotn Community Garnahovit**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	Fair	Possible	

2. INTAKE STRUCTURE

No.	Water source	N	E	El. (m)	Year	Material	Volume (l/s)	Rehabilitation Necessity (Y/N)
1	Spring	40°29'56.9"	43°58'54.4"	2,339	1952	Concrete	4.0	Yes
2	Spring	40°29'57.5"	43°58'06.4"	2,242	1953	grunt	0.8	Yes
3	Spring	40°30'02.3"	43°58'03.3"	2,141	1958	Concrete	1.0	Yes

3. TRANSMISSION PIPELINE

No.	Pipeline length (m)	Pipe diameter	Material	Flow rate (l/s)	Year	Leakage	Rehabilitation Necessity (Y/N)
1	1,200	150	Steel	3.4	1952	Medium	Yes
2	50	50	Steel	0.76	1953	Little	Yes
3	150	50	Steel	0.95	1958	Little	Yes
4	150	100	Steel	4.75	1952	Little	Yes
5	650	80	Steel	3.0	2001	Little	No

4. RESERVOIR

No.	N	E	El. (m)	Material	Shape	Dimension (m)	Volume (m3)	Rehabilitation Necessity (Y/N)
1	40°30'07.4"	43°57'38.8"	2210	reinforced concrete	Rectangular	4x4x3,5	50	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	1,000	50	Steel	2001	Little	Yes
2	800	80	Steel	1953	Medium	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)
2	1953		No	0	Yes

9. DRAINAGE SYSTEM

Existence (Y/N)	Rehabilitation Necessity (Y/N)	Remarks
No	Yes	

Questionnaire on Existing Water Supply Conditions by Socio-Economic Survey

Marz	Aragatsotn
Number and Name of Community	No.15 Garnahovit
District	Talin

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

A: Baseline Data

A1	Actual population in 2001	455
A2	Actual population in 2007	455
A3	Number of households	110
A4.1	Elderly people	60
A4.2	Population in labor force (age from 16 to 62)	245
A4.3	Children	150
A5.1	Pensioners	97
A5.2	Unemployed	0
A5.3	Receiving benefits	21
A6	Average monthly income of household (AMD)	20,000
A7	Number of medical ambulance station/first and health post	absent
A8	Number of beds in each medical ambulance station	0
A9	Number of school	1
A10	Number of pupils	110

B: Budget

B1	Annual Budget of the community 2004, in thousand AMD	3,000
	Annual Budget of the community 2005, in thousand AMD	3,240
	Annual Budget of the community 2006, in thousand AMD	3,440
	Annual Budget of the community 2007, in thousand AMD	2,000
	Annual Budget of the community 2008, in thousand AMD	is not planned.
B2	Amount spent in drinking water sector 2004, in thousand AMD	30
	Amount spent in drinking water sector 2005, in thousand AMD	25
	Amount spent in drinking water sector 2006, in thousand AMD	50
	Amount spent in drinking water sector 2007, in thousand AMD	30
	Amount spent in drinking water sector 2008, in thousand AMD	is not planned.

C: Socio-Economic Survey

C1	Major industries of the community:	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	yes
D2	Water use permit number	0743
D3	Date of expiry of water use permit	14.06.05-14.06.08
D4	Planned date of obtaining water use permit	
D5	Present condition of the water supply volume of Domestic use	2- almost sufficient
D6	Present condition of the water supply volume of Irrigation water	insufficient
D7	Number of house connection to drinking water system	60
D8	How many house connection household set the water meter	0
D9	Number of public taps	5
D10.1	How is the regime of water supply in your community in the dry season?	regularly 3-4 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?	8-10; 19-21
D12	Are you pleased with duration of domestic water supply?	mainly displeased
D13	Are hours of water supply convenient?	mainly 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?	-

No.	Question	Answer
D14.2	Estimate quantity of domestic water use of each household (litter per day)	400
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 1-Flat rate, 2 Having water tariff	-
D19	Where do you acquire the irrigation water?	pipelines
D20	Are you satisfied with irrigation water supply volume?	sufficient

E: Present Operation and Maintenance Works

E1	Name of responsible for water supply	no data
E2	Position	no data
E3	Telephone	-
E4	Quantity and present condition of the water supply facilities: spring/ intake	2 - partially repaired
E5	Quantity and present condition of the water supply facilities:	1- deteriorated
E6	Quantity and present condition of the water supply facilities: DRR(Daily Regulatory Reservoir)	1-is not used
E7	Quantity and present condition of the water supply facilities: net/distribution pipes	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?	absent
E14	How you prepare O&M costs?	community budget
E15	Please indicate the O&M cost breakdown per year for water supply	
	Electricity (AMD)	0
	Labor cost (AMD)	10,000
	Repair cost(AMD)	40,000
	Others(AMD)	0
	Total (AMD)	50,000
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 ethnic, indigenous people or nomads who have a traditional lifestyle or special socially valuable areas	absent

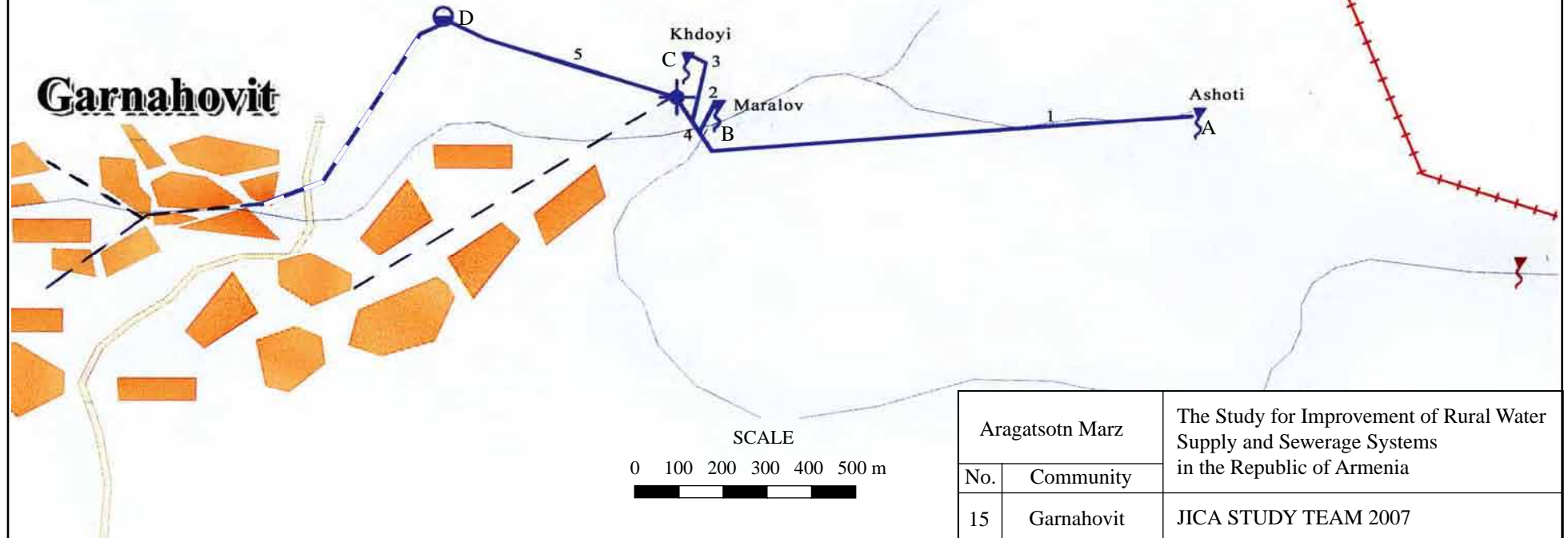


Pipeline length (m)	Pipe diameter (mm)	Material
TRANSMISSION PIPELINE		
1. 1200	150	Steel
2. 50	50	
3. 150	50	
4. 150	100	
5. 650	80	
DISTRIBUTION PIPELINE		
1000	50	Steel
800	80	

LEGENDS

-  Spring intake
-  Operating DRR
-  Regulation chamber
-  Transmission pipeline
-  Distribution pipeline

	N	E	H (m)
A	40°29'56.9"	43°58'54.4"	2339
B	40°29'57.5"	43°58'06.4"	2242
C	40°30'02.3"	43°58'03.3"	2241
D	40°30'07.4"	43°57'38.8"	2210



Aragatsotn Marz		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
No.	Community	
15	Garnahovit	JICA STUDY TEAM 2007

Marz : **Aragatsotn**
Name : **Garnahovit**

No.15

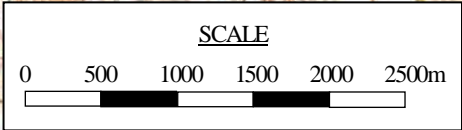
No.	Item	Quantity	Unit	Water demand (m3/d)
A. WATER DEMAND				
1	Population	455	persons	45.5
2	Factory	-	nos	0.0
3	School (pupils)	110	pupils	1.1
4	Medical Ambulance Station	-	nos	-
5	Policlinic	-	nos	-
6	Livestocks (87lit/household)	110	household	9.6
	Sub-total			56.2
	Unaccounted for water (20%)			11.2
1	Average Daily Water Demand			67.4 m3/day
2	Maximum Daily Water Demand			80.9 m3/day
3	Maximum Hourly Water Demand			15.3 m3/hr
B. WATER SUPPLY PLAN				
	1 Water source type	Nr.	Total vol.	
	a Spring	3	5.8 lit/sec	501.1 m3/day
	Total			501.1 m3/day
	2 Required reservoir volume			184 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	700	m	
	90mm diameter		m	
	110mm diameter	2,300	m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
3	Reservoir			
	200m3 capacity	1	nos	
4	Distribution pipe			
	50mm diameter	1,000	m	
	75mm diameter		m	
	90mm diameter	800	m	
	110mm diameter		m	
	150mm diameter		m	
	200mm diameter		m	
	250mm diameter		m	
5	House connection	50	nos	
6	Water meter installation	110	nos	
7	Public tap	2	nos	
8	Chlorination	1	nos	
9	Pumps	-	nos	



Distribution Pipes

Diameter	Length
50mm	1.0km
90mm	0.8km



Legend

	/		Intake Existing/ to be rehabilitated
	/		Reservoir Existing/ to be rehabilitated
	/		Pipeline Existing/ to be rehabilitated

Water Supply Facilities Rehabilitation Plan		The Study for Improvement of Rural Water Supply and Sewerage Systems in the Republic of Armenia
Marz	Aragatsotn	
No. 15	Gernahovit	JICA STUDY TEAM

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

Marz : **Aragatsotn**
No. : **15**
Name : **Garnahovit**

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	700	m	7,160	5,012,000
		90mm		m	8,040	
		110mm	2,300	m	9,680	22,264,000
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					27,276,000
3	Reservoir	50m3		nos	8,363,900	
		100m3		nos	12,968,300	
		150m3		nos	18,804,500	
		200m3	1	nos	22,524,600	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					22,524,600
4	Distribution Pipe	50mm	1,000	m	5,520	5,520,000
		75mm		m	7,160	
		90mm	800	m	8,040	6,432,000
		110mm		m	9,680	
		150mm		m	13,140	
		200mm		m	19,440	
		250mm		m	27,040	
	Sub-total					11,952,000
5	House Connection		50	nos	74,000	3,700,000
6	Water Meter Installation		110	nos	80,000	8,800,000
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		720	m	3,600	2,592,000
Total					AMD	78,627,700
					Equivalent to USD	257,357
					Equivalent to JPY	27,151,160
					AMD	USD
	Investment Cost per household		110	HH	714,797	2,340
	Investment Cost per person		455	persons	172,808	566

ARAGATSOTN MARZ
Talin District
No 15 Garnahovit

FINANCIAL ANALYSIS

A COST RECOVERY ANALYSIS

Item	Millon AMD	Rate
1 Revenue		
Water fee revenue	114.55	71.3%
Subsidy	46.19	28.7%
Total	160.74	100.0%
2 Expenditure		
OM cost	33.40	20.8%
Loan repayment	103.02	64.1%
Interest paid	24.32	15.1%
Surplus cash	0.00	0.0%
Total	160.74	100.0%

B. FIR R CALCULATION

Description	Total	Year																																						Unit: million AMD															
		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	92.53	2.30	1.64	38.62	38.50	10.88	0.33	0.26																																															
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	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	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	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00					
Maintenance cost	5.22			0.06	0.12	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14				
Pump replacement																																																							
Sub-total	17.32			0.33	0.43	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46			
Total Outflow	109.85	2.30	1.64	38.95	38.93	11.34	0.79	0.72																																															
B BENEFIT																																																							
1. Water Tariff	72.09	0.00	0.00	0.32	0.65	0.74	0.76	1.29	1.33	1.38	1.42	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14
2. Subsidy	25.85	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.41	1.39	1.36	1.35	1.32	1.29	1.27	1.24	1.21	1.17	1.13	1.09	1.06	1.01	0.98	0.94	0.87	0.83	0.77	0.72	0.65	0.60	0.54	0.45	0.40	0.32	0.23	0.17	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
Total Inflow	97.94	0.00	0.00	0.33	0.65	0.74	0.76	1.29	1.33	1.38	1.42	3.55	3.53	3.50	3.49	3.46	3.43	3.41	3.38	3.35	3.31	3.27	3.23	3.20	3.15	3.12	3.08	3.01	2.97	2.91	2.86	2.79	2.74	2.68	2.59	2.54	2.46	2.37	2.31	2.21	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14
NET BENEFIT	-11.91	-2.30	-1.64	-38.62	-38.3	-10.6	-0.03	0.57	0.87	0.92	0.96	3.09	3.07	3.04	3.03	3.00	2.97	2.95	2.92	2.89	2.85	2.81	2.77	2.74	2.69	2.66	2.62	2.55	2.51	2.45	2.40	2.33	2.28	2.22	2.13	2.08	2.00	1.91	1.85	1.75	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68			
FIRR =	-0.69%																																																						

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	-41.07	-2.53	-1.80	-42.5	-42.1	-11.7	-0.06	0.54	0.87	0.92	0.96	3.09	3.07	3.04	3.03	3.00	2.97	2.95	2.92	2.89	2.85	2.81	2.77	2.74	2.69	2.66	2.62	2.55	2.51	2.45	2.40	2.33	2.28	2.22	2.13	2.08	2.00	1.91	1.85	1.75	1.68
	2 Capital cost 20% up	-49.77	-2.76	-1.97	-46.3	-46.0	-12.8	-0.10	0.52	0.87	0.92	0.96	3.09	3.07	3.04	3.03	3.00	2.97	2.95	2.92	2.89	2.85	2.81	2.77	2.74	2.69	2.66	2.62	2.55	2.51	2.45	2.40	2.33	2.28	2.22	2.13	2.08	2.00	1.91	1.85	1.75	1.68
2	1 OM cost 10% up	-33.59	-2.30	-1.64	-38.7	-38.3	-10.6	-0.08	0.52	0.82	0.87	0.91	3.04	3.02	2.99	2.98	2.95	2.92	2.90	2.87	2.84	2.80	2.76	2.72	2.69	2.64	2.61	2.57	2.50	2.46	2.40	2.35	2.28	2.23	2.17	2.08	2.03	1.95	1.86	1.80	1.70	1.63
	2 OM cost 20% up	-34.80	-2.30	-1.64	-38.7	-38.4	-10.7	-0.12	0.48	0.78	0.83	0.87	3.00	2.98	2.95	2.94	2.91	2.88	2.86	2.83	2.80	2.76	2.72	2.68	2.65	2.60	2.57	2.53	2.46	2.42	2.36	2.31	2.24	2.19	2.13	2.04	1.99	1.91	1.82	1.76	1.66	1.59
3	1 Revenue 10% down	-39.05	-2.30	-1.64	-38.7	-38.3	-10.7	-0.11	0.44	0.74	0.78	0.82	2.74	2.72	2.69	2.68	2.65	2.63	2.61	2.58	2.56	2.52	2.48	2.45	2.42	2.38	2.35	2.31	2.25	2.21	2.16	2.11	2.05	2.01	1.95	1.87	1.83	1.75	1.67	1.62	1.53	1.47
	2 Revenue 20% down	-45.71	-2.30	-1.64	-38.7	-38.4	-10.7	-0.18	0.31	0.60	0.64	0.68	2.38	2.36	2.34	2.33	2.31	2.28	2.27	2.24	2.22	2.19	2.16	2.12	2.10	2.06	2.04	2.00	1.95	1.92	1.87	1.83	1.77	1.73	1.68	1.61	1.57	1.51	1.44	1.39	1.31	1.25

No.	Description	FIRR	Sensitivity indicator	Swiching value
1	1 Capital cost 10% up	-1.15%	-4.02	-24.89%
	2 Capital cost 20% up	-1.57%	-5.60	-17.86%
2	1 OM cost 10% up	-0.80%	-1.33	-75.46%
	2 OM cost 20% up	-0.90%	-2.35	-42.51%
3	1 Revenue 10% down	-1.32%	-4.75	-21.03%
	2 Revenue 20% down	-2.01%	-6.57	-15.23%