

**TECHNICAL INDICATORS OF THE WSS INFRASTRUCTURE IN THE URBAN AREAS
UNDER REVIEW AND THE RESULTS OF CALCULATIONS FOR THE BASELINE
SCENARIO**

1. TECHNICAL INDICATORS OF THE URBAN WSS INFRASTRUCTURE

1.1 Water supply

**Table 1. Number of people receiving water from centralized water supply systems
and the amount of water supplied**

The name of the city, town	Number of people connected to the centralized water supply system, persons		Share of people receiving water from centralized systems (including street water stand posts), %		Total water use (water pumped into the network), lcd		Share of water abstracted from underground sources, %	
	Base year 2002	Target year 2015	Base year	Target year	Base year	Target year	Base year	Target year
Yerevan*	986 000	1 000 000	100%	100%	954	265	100%	100%
Alaverdi	13 400	13 400	100%	100%	576	576	100%	100%
Aparan	6 600	6 600	100%	100%	328	328	100%	100%
Ararat	11 900	11 900	100%	100%	290	290	100%	100%
Martuni	9 000	9 000	100%	100%	356	356	100%	100%
Artashak	18 400	18 400	100%	100%	2 032	2 032	100%	100%
Ashtarak	20 700	20 700	100%	100%	527	527	100%	100%
Berd	6 900	6 900	100%	100%	318	318	0%	0%
Dilizhan	9 000	9 000	99%	99%	360	360	13%	13%
Echmiadzin	35 100	35 100	100%	100%	1 119	1 119	100%	100%
Gavar	20 000	20 000	100%	100%	799	799	100%	100%
Gyumri	135 500	135 500	100%	100%	529	529	100%	100%
Masis	15 800	15 800	100%	100%	1 672	1 672	100%	100%
Razdan	51 800	51 800	100%	100%	543	543	100%	100%
Sevan	17 900	17 900	100%	100%	1 159	1 159	100%	100%
Tsakhkadzor	2 600	2 600	98%	98%	882	882	80%	80%
Sisian	11 500	11 500	100%	100%	546	546	100%	100%
Vanadzor	84 200	84 200	100%	100%	395	395	72%	72%
Vardenis	8 700	8 700	100%	100%	293	293	100%	100%

* hereafter, population means the number of people receiving WSS services from Yerevan Vodocanal and Armenian Vodocanal (according to the signed contracts)

Source: statistical data provided by the Yerevan Vodocanal and Armenian Vodocanal and the calculation results and assumptions of the working group

According to the Baseline scenario, rehabilitation of water supply systems in 1999-2004 is limited to the city of Yerevan using the first WB loan allocated for the Municipal development programme.

1.2 Wastewater discharge

Table 2. Number of people discharging wastewater into the sewerage system and amount of the wastewater discharged, type of treatment and WWTP capacity (base year 2002)

The name of the city / town	Share of people connected to centralised sewerage system	Wastewater discharged into the sewerage system, m ³ /year	Type of treatment	WWTP capacity, m ³ /day
Yerevan	96%	85 200 000	M (partially)	600 000
Alaverdi	57%	839 500	No treatment	0
Aparan	60%	240 000	No treatment	0
Ararat	38%	430 000	No treatment	0
Martuni	50%	300 000	No treatment	
Artashak	55%	2 550 000	No treatment	0
Ashtarak	53%	800 000	No treatment	10 000
Berd	47%	220 000	No treatment	0
Dilizhan	53%	380 000	No treatment	0
Echmiadzin	62%	3 100 000	M (partially)	35 200
Gavar	49%	1 250 000	No treatment	0
Gyumri	56%	5 820 000	No treatment	0
Masis	52%	800 000	M (partially)	53 000
Razdan *	69%	2 800 000	M (partially)	64000 *
Sevan *	58%	1 400 000	M (partially)	
Tsakhkadzor *	60%	210 000	M (partially)	
Sisian	41%	210 000	No treatment	0
Vanadzor	70%	2 660 000	M (partially)	28 200
Vardenis	48%	320 000	No treatment	0

* wastewater is treated at the WWTP in the village of Kakhsi, its capacity is 64 000 m³/day

M – mechanical treatment

Source: statistical data, calculation results, data of experts and assumptions of the working group

2. RESULTS OF THE CALCULATIONS FOR THE BASELINE SCENARIO

Tables 3 and 4 below show the results of calculations using the FEASIBLE model for the Baseline scenario. All calculations are made in constant prices of the base year 2002. The target year is the year 2015. The results of calculations produced by the model were rounded; also, it is necessary to take into consideration the fact that these calculations were based on the so-called generic cost functions in prices of Western Europe converted into local prices using so called price correction factors and, therefore, have some inaccuracies. The average exchange rate of Euro for this period was taken at 1 EUR = 650 AMD, the average exchange rate of the dollar was taken at 1 USD = 565 AMD.

Users charges here mean the charges actually received (not billed), and are counted on cash basis.

The following designations are used for calculations:

- **Cost coverage deficit I:** the difference between the operation expenditure needs and the user charges actually collected for the WSS services;
- **Cost coverage deficit II:** the difference between the total expenditure needs (including operations, maintenance, capital repairs and compensation for the fixed assets depreciation – assets renewal in line with the depreciation rates) and the user charges collected for the WSS services.

Note: the total amounts in the tables may have some divergences due to rounding of numbers.

Table 3. Expenditure needs, finance available and the financing gap for the Baseline scenario in million drams

Funding sources:	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
WSS user charges revenue															
Population	1 919	4 212	5 838	6 189	6 560	6 953	7 371	7 813	8 282	8 779	9 305	9 864	10 455	11 083	104 623
Industrial and commercial organizations	985	985	985	965	965	965	965	965	965	965	965	965	965	965	13 573
Budgetary organizations	470	470	470	470	470	470	470	470	470	470	470	470	470	470	6 580
Public budget															
Operating subsidies	1 478	2 798	1 973	1 845	607	483	512	542	383	406	431	457	484	513	12 913
Capital investments and repairs	370	1 199	845	1 230	911	1 127	1 194	1 266	1 533	1 625	1 723	1 826	1 936	2 052	18 837
Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loans	3 434	5 719	1 917	270	0	0	0	0	0	0	0	0	0	0	11 340
TOTAL funding	8 656	15 383	12 028	10 969	9 513	9 998	10 512	11 056	11 634	12 246	12 894	13 582	14 311	15 083	167 866
Expenditure needs, total	45 963	44 649	43 336	42 022	36 965	36 965	36 965	36 965	36 965	36 965	37 111	37 355	37 437	37 448	547 110
<i>including:</i>															
Current operations	17 713	16 917	16 121	15 325	14 529	14 529	14 529	14 529	14 529	14 529	14 529	14 529	14 529	14 529	211 367
Maintenance and compensation for the fixed assets depreciation	24 506	23 988	23 471	22 953	22 436	22 436	22 436	22 436	22 436	22 436	22 436	22 436	22 436	22 436	319 276
Rehabilitation	3 744	3 744	3 744	3 744	0	0	0	0	0	0	0	0	0	0	14 975
New construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Debt service (loans)	0	0	0	0	0	0	0	0	0	0	146	390	472	483	1 492
Annual financing gap	37 307	29266	31 307	31 053	27 451	26 967	26 453	25 908	25 331	24 719	24 217	23 773	23 126	22 365	379 244
Cost coverage deficit I	14 339	11 250	8 828	7 701	6 534	6 140	5 723	5 281	4 812	4 315	3 788	3 230	2 638	2 011	86 591
Cost coverage deficit II	38 845	35 239	32 299	30 655	28 970	28 576	28 159	27 717	27 248	26 751	26 370	26 056	25 546	24 930	407 359
Deficit of funds for maintenance, capital repair and compensation for the fixed assets depreciation	20 702	17 070	20 708	21 453	21 525	21 309	21 242	21 170	20 902	20 810	20 713	20 610	20 500	20 384	289 099

Source: calculations using the FEASIBLE model

Table 4. Additional financing received through implementation of the suggested package of policy measures to cover the initial financing gap in the Basic scenario in million drams

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Increase in user charges paid by population														
Higher tariff	0	1 283	3 510	5 404	7 512	7 963	8 441	8 947	9 484	10 053	10 656	11 295	11 973	12 692
Increased collection rate	0	0	0	682	828	877	930	986	1 045	1 108	1 174	1 245	1 319	1 398
Increase in user charges paid by industries and commercial organisations														
Higher tariff	0	0	985	1 231	1 231	1 231	1 231	1 231	1 231	1 231	1 231	1 231	1 231	1 231
Increase in user charges paid by budgetary organisations														
Higher tariff	0	0	470	588	588	588	588	588	588	588	588	588	588	588
Additional public funding	0	0	3 813	4 885	6 832	7 242	7 676	8 137	8 625	9 143	9 153	7 990	6 352	5 130
Additional loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total additional financing	0	1 283	8 778	12 789	16 991	17 901	18 866	19 889	20 973	22 122	22 802	22 349	21 463	21 039
Saving of electricity (monetary value)	0	0	500	1 000	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800	1 800
Initial annual financing gap *	37 307	29 266	31 307	31 053	27 451	26 967	26 453	25 908	25 331	24 719	24 217	23 773	23 126	22 365
New annual financing gap	37 307	27 983	22 030	17 263	8 661	7 266	5 787	4 220	2 558	797	-385	-376	-137	-474

New funding from the main sources:	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
WSS user charges revenue															
Population	1 919	5 495	9 348	12 274	14 900	15 794	16 741	17 746	18 811	19 939	21 136	22 404	23 748	25 173	225 428
Industrial and commercial organisations	985	985	1 970	2 197	2 197	2 197	2 197	2 197	2 197	2 197	2 197	2 197	2 197	2 197	28 102
Budgetary organisations	470	470	940	1 058	1 058	1 058	1 058	1 058	1 058	1 058	1 058	1 058	1 058	1 058	13 513
Public Budget	1 848	3 998	6 631	7 960	8 350	8 851	9 382	9 945	10 542	11 174	11 306	10 273	8 772	7 695	116 727

Source: calculations using the FEASIBLE model

WSS INFRASTRUCTURE DEVELOPMENT TARGETS AND THE RESULTS OF CALCULATIONS FOR THE DEVELOPMENT SCENARIO

1. WSS INFRASTRUCTURE DEVELOPMENT TARGETS

Tables 1–6 show **WSS infrastructure development targets anticipated by the Development scenario** for each urban area under consideration, and the target years for their achievement.

1.1. Water supply

Table 1. Number of people receiving water from centralized water supply systems and the amount of water supplied in the base year 2002 and in the target year 2015

The name of the city / town	Number of people connected to the centralized water supply system, persons		Share of people receiving water from centralized systems (including street water stand posts), %		Total water use (water pumped into the network), lcd		Share of water abstracted from underground sources, %	
	Base year 2002	Target year 2015	Base year	Target year	Base year	Target year	Base year	Target year
Yerevan*	986 000	1 000 000	100%	100%	954	265	100%	100%
Alaverdi	13 400	13 400	100%	100%	576	160	100%	100%
Aparan	6 600	6 600	100%	100%	328	160	100%	100%
Ararat	11 900	11 900	100%	100%	290	160	100%	100%
Martuni	9 000	9 000	100%	100%	356	160	100%	100%
Artashak	18 400	18 400	100%	100%	2 032	160	100%	100%
Ashtarak	20 700	20 700	100%	100%	527	160	100%	100%
Berd	6 900	6 900	100%	100%	318	160	0%	0%
Dilizhan	9 000	9 000	99%	99%	360	160	13%	13%
Echmiadzin	35 100	35 100	100%	100%	1 119	160	100%	100%
Gavar	20 000	20 000	100%	100%	799	160	100%	100%
Gyumri	135 500	135 500	100%	100%	529	160	100%	100%
Masis	15 800	15 800	100%	100%	1 672	160	100%	100%
Razdan	51 800	51 800	100%	100%	543	160	100%	100%
Sevan	17 900	17 900	100%	100%	1 159	160	100%	100%
Tsakhkadzor	2 600	2 600	98%	98%	882	160	80%	80%
Sisian	11 500	11 500	100%	100%	546	160	100%	100%
Vanadzor	84 200	84 200	100%	100%	395	160	72%	72%
Vardenis	8 700	8 700	100%	100%	293	160	100%	100%

* hereafter, population means the number of people receiving WSS services from Yerevan Vodocanal and Armenian Vodocanal (according to the signed contracts)

Source: statistical data provided by the Yerevan Vodocanal and Armenian Vodocanal and the calculation results and assumptions of the Working group of experts

Table 2. Capital expenditure needs for water supply infrastructure rehabilitation and construction (in % of the capital expenditure on construction of a new structure of the same type and capacity)

The name of the city/town	Water abstraction and water conditioning plants, %		Water supply distribution networks, %
	Groundwater	Surface water	
Yerevan	20%	0%	10%
Alaverdi	50%	0%	10%
Aparan	30%	0%	10%
Ararat	20%	0%	10%
Martuni	20%	0%	10%
Artashak	60%	0%	10%
Ashtarak	20%	0%	10%
Berd	0%	50%	10%
Dilizhan	0%	50%	10%
Echmiadzin	30%	0%	10%
Gavar	20%	0%	10%
Gyumri	40%	0%	10%
Masis	20%	0%	10%
Razdan	20%	0%	10%
Sevan	30%	0%	10%
Tsakhkadzor	10%	20%	10%
Sisian	20%	0%	10%
Vanadzor	50%	50%	10%
Vardenis	20%	0%	10%

Source: proposals of the SC and the Working Group of experts

1.2 Wastewater collection

Table 3. Coverage of population by the sewerage system and the amount of wastewater collected to the sewerage system

The name of the city / town	Amount of the wastewater collected to the sewerage system, m3/year	The share of population connected to the sewerage system	
		Base year	Target year 2015
	Base year 2002	Base year	Target year 2015
Yerevan	85 200 000	96%	98%
Alaverdi	839 500	57%	65%
Aparan	240 000	60%	70%
Ararat	430 000	58%	65%
Martuni	300 000	50%	60%
Artashak	2 550 000	55%	65%
Ashtarak	800 000	53%	70%
Berd	220 000	47%	60%
Dilizhan	380 000	53%	60%
Echmiadzin	3 100 000	62%	70%
Gavar	1 250 000	49%	60%
Gyumri	5 820 000	56%	65%
Masis	800 000	52%	60%
Razdan	2 800 000	69%	75%
Sevan	1 400 000	58%	65%
Tsakhkadzor	210 000	60%	70%
Sisian	210 000	41%	55%
Vanadzor	2 660 000	70%	80%
Vardenis	320 000	48%	55%

Source: statistical data, type of treatment and capacity of WWTP

Table 4. Type of treatment and WWTP capacity

The name of the city / town	Type of treatment		WWTP capacity, m3 /day	
	Base year	Target year	Base year	Target year
Yerevan	M (partially)	M	600 000	400 000
Alaverdi	No treatment	M	0	4 000
Aparan	No treatment	M	0	2 000
Ararat	No treatment	M	0	4 000
Martuni	No treatment	M	0	2 000
Artashak	No treatment	M	0	8 000
Ashtarak	M (partially)	M	10 000	4 000
Berd	No treatment	M	0	2 000
Dilizhan	No treatment	M	0	2 000
Echmiadzin	M (частично)	M	35 200	10 000
Gavar	No treatment	M	0	5 000
Gyumri	No treatment	M	0	20 000
Masis	M (partially)	M	53 000	4 000
Razdan *	M (partially)	M	64 000 *	16 000 *
Sevan *	M (partially)	M		
Tsakhkadzor *	M (partially)	M		
Sisian	No treatment	M	0	1 000
Vanadzor	M (partially)	M	28 200	10 000
Vardenis	No treatment	M	0	1 500

* treated at the WWTP near the village of Kakhsi

M – mechanical treatment

Source: data of experts and assumptions of the working group

Table 5. Capital expenditure needs for the rehabilitation and construction of wastewater collection and treatment infrastructure (in % of the cost of construction of a new structure of the same type and capacity)

The name of the populated locality	Outdoor sewerage networks, %	Wastewater treatment plants, %
Yerevan	10%	30%
Alaverdi	10%	20%
Aparan	10%	20%
Ararat	10%	20%
Martuni	10%	100%
Artashak	10%	20%
Ashtarak	10%	20%
Berd	10%	20%
Dilizhan	10%	20%
Echmiadzin	10%	20%
Gavar	10%	100%
Gyumri	10%	20%
Masis	10%	20%
Razdan *	10%	20% *
Sevan *	10%	
Tsakhkadzor *	10%	
Sisian	10%	20%
Vanadzor	10%	20%
Vardenis	10%	100%

* when rehabilitating the WWTP near the village of Kakhsi it is planned to reduce its capacity down to 16,000 m3/day

Table 6. Projected periods for implementation of planned actions

The name of the city / town	Water supply		Wastewater collection and treatment	
	Start year	End year	Start year	End year
Yerevan	1999	2005	2005	2009
Alaverdi	2005	2009	2009	2015
Aparan	2005	2009	2009	2015
Ararat	2005	2009	2009	2015
Martuni	2005	2009	2006	2009
Artashak	2005	2009	2009	2015
Ashtarak	2005	2009	2007	2010
Berd	2005	2009	2009	2015
Dilizhan	2005	2009	2009	2015
Echmiadzin	2005	2009	2007	2010
Gavar	2005	2009	2006	2009
Gyumri	2005	2009	2009	2015
Masis	2005	2009	2009	2015
Razdan	2005	2009	2006	2009
Sevan	2005	2009	2006	2009
Tsakhkadzor	2005	2009	2006	2009
Sisian	2005	2009	2009	2015
Vanadzor	2005	2009	2009	2015
Vardenis	2005	2009	2006	2009

Source: data of experts and assumptions of the working group

2. RESULTS OF CALCULATIONS USING THE FEASIBLE MODEL, FOR THE DEVELOPMENT SCENARIO

Tables 7 and 8 below show the results of calculations using the FEASIBLE model for the Development scenario. All calculations were made in constant prices, base year 2002. The target year is 2015. The results of calculations based on the model are rounded; also, it is necessary to take into account that these calculations were based on the so-called generalized functions of costs in prices of Western Europe converted into local prices using the price adjustment factor and, therefore, have some inaccuracies. The average exchange rate of Euro for this period was taken at 1 EUR = 650 AMD, the average exchange rate of the dollar was taken at 1 USD = 565 AMD.

Users charges here mean the charges actually received (not billed), on a cash basis.

The following designations are used for calculations:

- **Cost coverage deficit I:** the difference between the operation expenditure needs and the actually collected user charges for the WSS services;
- **Cost coverage deficit II:** the difference between the total expenditure needs (including operations, maintenance, capital repairs and compensation for the fixed assets depreciation – assets renewal in line with the depreciation rates) and the collected user charges for the WSS services.

Note: the total amounts in the tables may have some divergences due to rounding of numbers.

Table 7. Expenditure needs, finance available and the financing gap for the Development scenario in million drams

Funding sources:	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
User charges for WSS paid by															
Population	1 919	4 212	5 838	6 553	6 946	7 363	7804	8 273	8 769	9295	9 853	10 444	11 071	11 735	110073
Industrial and commercial organizations	985	985	1 862	2 058	2 058	2 058	2 058	2 058	2 058	2 058	2 058	2 058	2 058	2 058	26470
Budgetary organizations	470	470	900	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	12840
Public budget															
Operating subsidies	1 478	2 798	4 642	4 776	0	0	0	0	0	0	0	0	0	0	13694
Capital investments and capital repairs	370	1 199	1 989	3 184	8 350	8 851	9 382	9 945	10 542	10 159	9 691	9 131	8 772	7 695	99260
Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loans	3 772	6 057	3 822	16 858	16 588	8 885	8 885	8 885	0	0	0	0	0	0	73 752
TOTAL funding	8 994	15 721	19 053	34 429	34 942	28 157	29 129	30 161	22 369	22 512	22 602	22 633	22 900	22 488	336 089
Expenditure needs, total	45 963	44 649	43 336	64 604	61 508	62 160	61 632	65 718	40 194	39 153	39 453	39 852	40 154	41 013	689 389
Including:															
Operations	17 713	16 917	16 121	15 325	14 262	14 019	13 784	13 549	13 387	13 466	13 538	13 611	13 683	13 755	203 132
Maintenance and compensation for the fixed assets depreciation	24 506	23 988	23 471	22 953	22 110	21 808	21 514	21 221	20 995	21 072	21 139	21 207	21 275	21 342	308 600
Rehabilitation	3 744	3 744	3 744	23 660	21 184	21 726	21 726	23 384	2 200	1 658	1 658	1 658	1 658	1 658	133 399
New construction	0	0	0	2 665	3 952	4 607	4 607	7 564	3 612	2 957	2 957	2 957	2 957	2 957	41 795
Debt service (loans)	0	0	0	0	0	0	0	0	0	0	161	419	582	1 300	2 462
Annual financing gap	36 969	28 928	24 283	30 175	26 566	34 003	32 502	35 558	17 825	16 641	16 852	17 218	17 254	18 525	353 299
Cost coverage deficit I	14 339	11 250	7 521	5 714	4 258	3 599	2 922	2 219	1 560	1 113	628	109	0	0	55 232
Cost coverage deficit II	38 845	35 239	30 992	28 668	26 368	25 406	24 436	23 440	22 555	22 185	21 928	21 735	21 411	21 605	364 812
Deficit of funds for maintenance, capital repair and compensation for the fixed assets depreciation	20 364	16 732	17 660	2 911	-2 828	4 071	3 247	2 391	10 453	10 913	11 448	12 076	12 503	13 647	135 588

Source: calculations using the FEASIBLE model

Table 8. New financing from main sources, received through implementing the proposed policy package to cover the initial financing gap in the Development scenario in million drams

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
New financing, total	8 994	17 005	24 448	42 632	46 039	40 267	41 788	43 400	36 224	37 019	37 802	38 566	39 611	40 022	493 818
<i>Including funds from the main sources:</i>															
WSS user charges revenues															
Population	1 919	5 495	9 348	12 274	15 562	16 496	17 485	18 535	19 647	20 825	22 075	23 399	24 803	26 292	234 156
Industrial and commercial organizations	985	985	2 847	3 289	3 289	3 536	3 536	3 536	3 536	3 536	3 536	3 536	3 536	3 536	43 215
Budgetary organizations	470	470	1 800	2 250	2 250	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	2 500	29 740
Public budget	1 848	3 998	6 631	7 960	8 350	8 851	9 382	9 945	10 542	10 159	9 691	9 131	8 772	7 695	112 954

Source: calculations using the FEASIBLE model