Chapter 9 O&M and Organizational Arrangement

Chapter 9 Operation and Maintenance and Organization Arrangement

9.1 Operation and Maintenance

9.1.1 Proposed system

The improvement of the water supply facilities as shown in Table 9.1.1 is proposed for 2011, the target year of the project for the F/S. Based on the proposed system, the operation and maintenance condition for staff assignment, electricity/chemical consumption will be improved.

Table 9.1.1 Proposed System in 2011

Facilities		Contents of improvement/replacement
WTP	Kadirya	Replacement of Intake pump facilities
		Replacement of valves for Rapid filters
		Introduction of automaic-washing system for filters
		Replacement of water analysis equipment
	Kibray	Replacement of well pumps
		Pump distribution system changed to gravity
	Boz-su	Construction of new rapid filters with capacity of 100,000m^3/d
		Replacement of intake pump facilities
		Replacement of distribution pump facilities
	South	Partly distributing for surrounding area
Distribution network		The network was divided into four including Boz-su distribution areas
		Automatic pressure and flow regulation system was introduced
		Reinforcement pipes was installed
Booster PS		12 large scale PSs with monitoring system (sift operators are necessary)
		36 PSs were refurbished with auto-control and monitoring system
		115 pump units were installed
		35 PSs were not changed because they will be refurbished or abandoned later

9.1.2 Staff Assignment

Staff assignment will be changed as the water supply system is being improved. The major reasons behind the changes are as mentioned in Chapter 5.4.6. Table 9.1.2 shows the staff assignment plan for facility operation. It shows the present assignment as well as the assignments in the F/S and LTDP stage. Shift operators for the Kadirya, Boz-su and Kibray WTPs will be reduced because automatic operation system for the rapid filters will be introduced for Kadirya and Boz-su WTP, while and the pumps will be operated automatically

for wells to be installed for Kibray WTP by the EBRD Project. In addition, because monitoring system for those WTPs will be introduced by LTDP project, operation staff will be further reduced.

Table 9.1.2 Plan of Staff Assignment

Division	Name	Division	Shift operation	Operation	Machine/ electric/repair	Laboratory	Total
WTPs to be operated continuously	Kadirya	Present	88	60	21	11	180
		F/S	70	50	20	11	151
		LTDP	60	50	20	20	150
	Kibray	Present	60	87	36	10	193
		F/S	30	70	36	10	146
		LTDP	30	60	36	4	130
	Boz-su	Present	51	45	33	11	140
		F/S	45	40	32	11	128
		LTDP	40	40	30	11	121
Abandoned WTPs	South	Present	48	39	16	12	115
		LTDP	24	20	10	12	66
	Sergeli	Present	71	33	17	7	128
	Kara-su	Present	42	0	2	5	49
	Bectemir	Present	44	8	9	0	61
	Kuiluk	Present	21	5	9	0	35
	Total	Present	226	85	53	24	388
	Total	F/S	24	20	10	12	66
Booster PSs	PS Total	Present	585	173	36	0	794
	PSs Operation	F/S	172	44	30	0	246
		LTDP	56	44	20	0	120
	Patrol	F/S	40	60	10	0	110
		LTDP	40	60	10	0	110
	Total	F/S	212	104	40	0	356
		LTDP	96	104	30	0	230
Present total		Engineer	41	127	14	20	202
		Worker	969	323	165	36	1,493
		Total	1,010	450	179	56	1,695
Proposed total	Engineer	F/S	40	100	40	20	200
		LTDP	40	100	40	20	200
	Worker	F/S	341	184	98	24	647
		LTDP	186	154	76	15	431
	Total	F/S	381	284	138	44	847
		LTDP	226	254	116	35	631
Reduced number		F/S	629	166	41	12	848
		LTDP	784	196	63	21	1,064

The current number of staff members for booster PSs is quite large; however the number will decrease when the auto-operation and monitoring system will be introduced as by F/S. The staff in charge of patrol and some emergency shift operators will be re-assigned in the management office in Kara-su. However, some shift operators for the large-scale booster PSs will still have to be continuously assigned there, since some of these PSs will be improved in the LTDP stage. Table 9.1.3 shows the number of required shift operators and daytime operators working for large scale PSs that are not included in Table 9.1.2.

Table 9.1.3 Calculation for Number of Shift Operators

Target year	PS	Number	Unit shift operator	Unit daytime operator	Total shift operator	Total daytime operator
F/S	Mirzo Ulugbek/ Chilanzar	2	8	2	16	4
	Capacity 3000/1000m^3/hr	10	4	2	40	20
	Improved later	29	4	0	116	0
	Total	41			172	24
LTDP	Mirzo Ulugbek/ Chilanzar	2	8	2	16	4
	Capacity 3000/1000 m^3/hr	10	4	2	40	20
	Total	12			56	24

9.1.3 Power/ Chemical Consumption

(1) Power (Electricity) Consumption

In the target year for the F/S (2011), the South WTP will be retained and partly operated, so that the power consumption will have to be accounted for the WTP. The unit power consumption of Kibray WTP will be reduced by the replacement of well's pumps as shown in Chapter 5.4.2.

Since the amount of water distributed to the City in 2011 is larger than that in 2015, the water pressure of 26m, which allows the gravity distribution to low story buildings, in distribution pipes may not be ensured in many areas of the City. The estimated ratio of booster PSs with the pressure range over 26m will be 62% in 2011, and 90% in 2015.

Based on a detailed survey carried out for Hamza, Mirabad Sergeli and Bectemir District, it is estimated that electricity consumption of the PSs in 2011 against the present will be

reduced by 20%, in the case that the water pressure is over 26m; and by 38% in case it is less than 26m, including distribution PSs, as shown in Table 9.1.4(1) and (2).

Table 9.1.4 (1) Reduction of Power Consumption for PSs (Water Pressure 26m or more)

District	Total capacity (m^3/hr)	Number		Population		Required capacity (m^3/hr)		Power consumption (kW)	
		Current	Future	Current	Future	Current	Future	Current	Future
Hamza	5,970	14	3	122,056	56,921	3,233	933	569	100
Mirabad	5,535	13	5	98,911	47,810	2,514	767	511	86
Sergeli	11,000	5	4	125,975	101,872	3,932	1,595	713	175
Bectemir	310	2	1	6,066	4,442	657	74	107	21
Total	22,815	34	13	353,008	211,044	10,336	3,369	1,900	382
Ratio	---	1.00	0.38	1.00	0.59	0.45	0.15	1.00	0.20

Table 9.1.4 (2) Reduction of Power Consumption for PSs (Water Pressure under26m)

District	Total capacity (m^3/hr)	Number	Population		Required capacity (m^3/hr)		Power consumption (kW)	
			Current	Future	Current	Future	Current	Future
Hamza	5,970	14	122,056	122,056	3,233	2,035	569	280
Mirabad	5,535	13	98,911	98,911	2,514	1,602	511	209
Sergeli	11,000	5	125,975	125,975	3,932	2,100	713	220
Bectemir	1,220	2	6,066	6,066	657	101	107	21
Total	23,725	34	353,008	353,008	10,336	5,838	1,900	730
Ratio		1.00	1.00	1.00	0.44	0.25	1.00	0.38

From the weighted average of the abovementioned pressure categories of the two values (based on the findings of the results of pressure range for PSs in entire area of the City), the power consumption ratio against the present can be obtained as 0.268 in 2011 and 0.218 in 2015 as shown in Table 9.1.5.

In the actual calculation of electricity consumption, some margin was added to domestic demand (200 Lpcd to the design per capita consumption of 150Lpcd). The fraction of these values was omitted and was set at 0.26 in 2011 and 0.20 in 2015, respectively. Based on the modified ratios, power consumption can be calculated as shown in Table 9.1.6.

Table 9.1.5 Reduction Ratio of Electricity Consumption (%)

Classifications	Water pressure	Ratio to current value in Kibray area*1	PSs in whole City			
			2011		2015	
			Ratio of number*2	Ratio to current value*3	Ratio of number*2	Ratio to current value*3
Capacity	26m or more	20	62	26.8	89	22.0
	Under 26m	38	38		11	

*1: Distribution PSs in WTPs are included

*2: The each ratio of the number of PSs with water pressure of 26m or more and these with under 26m to the total number of PS in the City, for which water pressure was evaluated based on hydraulic simulation

*3: The decreased ratio of supply capacity and electricity consumption to the current values for the PSs when these will be improved in the target years, which the values of *1 multiply these of *2 for pressure range 26m or more, and under 26m, and each of them are added

Table 9.1.6 Power Consumption and Costs in Target Years

Category	Name	Unit consumption kWh/m^3			Water distribution 1000m^3/d			Electricity consumption GWh/y			Cost 1000USD (mil.soum)/y		
		2002	2011	2015	2002	2011	2015	2002	2011	2015	2002	2011	2015
WTPs to operated continuouly	Kadirya	0.105	0.110	0.11	2,100	1,340	1,224	80.3	53.8	49.1	2,409	1,614	1,474
	Kibray	0.423	0.200	0.20	354	312	312	54.6	22.8	22.8	1,638	683	683
	Boz-su	0.275	0.290	0.29	250	134	89	25.1	14.2	9.6	753	426	287
	South	0.170	0.170	0.17	142	45	0	8.8	2.8	0.0	264	84	0
	Total	0.162	0.140	0.137	2,846	1,831	1,625	168.8	93.6	81.5	5,064 (5,520)	2,807 (5,064)	2,445 (2,665)
Booster PSs	Existing	---	---	---	---	---	---	88.8	---	---	---	---	---
	Dis. in WTPs	---	---	---	---	---	---	11.0	---	---	---	---	---
	Total	0.094	0.039	0.034	2,900	1,831	1,625	99.8	25.9	20.0	2,994 (3,263)	778 (848)	599 (547)
Others		0.304	0.0	0.0	54.1	0.0	0.0	6.0	0.0	0.0	180	0	0
Sum-total		0.259	0.179	0.171	2,900	1,831	1,625	274.6	119.5	101.5	8,238 (8,979)	3,585 (3,907)	3,044 (3,318)

Note：The exchange rate between soum and USD is 1090 soum/USD applied for the rate in Dec.2004, electricity price by USD is same with the price for LTDP

(2) Chemical Consumption

The injection ratio of chlorine will be same with the current one, because this is considered the appropriate dosing ratio. However, the dosing ratio of coagulant at Kadirya WTP should be increased to the same level with Boz-su WTP in order to ensure better quality water being distributed, as mentioned in Chapter 5.4.6. The increase in dosing ratio will start in 2011.The result of the calculation of chemical consumption and costs are shown in Table 9.1.7.

Table 9.1.7 Chemical Consumption and Costs in Target Year

WTP name	Chemical name	Unit consumption			Distribution			Consumption			Cost		
		mg/l			1000m^3/d			t/year			1000USD (mil.soum)/y		
		2002	2111	2015	2002	2011	2015	2002	2011	2015	2002	2011	2015
Kadirya	Coagulant	2.0	10.0	10.0	2,100	1,340	1,224	1,533	4,891	4,468	165.3	527.2	481.6
	Liquid chlorine	0.7	0.7	0.7				523.3	342.4	312.7	83.7	54.8	50.0
Kibray	Chlorine	0.4	0.4	0.4	354	312	312	46.9	45.6	45.6	7.5	7.3	7.3
Boz-su	Coagulant	11.5	11.0	11.0	250	134	89	1,049	538.0	357.3	113.0	58.0	38.5
	Liquid chlorine	0.8	0.8	0.8				73.6	39.1	26.0	11.8	6.3	4.2
South	Liquid chlorine	0.3	0.3	---	143	45	0	15.6	4.9	0.0	2.5	0.8	0.0
Others	Liquid chlorine	---	---	---	197	0	0	3.4	0.0	0.0	0.5	0.0	0.0
	Hypochlorite	---	---	---				9.7	0.0	0.0	9.7	0.0	0.0
Total	Coagulant							2,582	5,429	4,825	278.3 (303.4)	585.2 (637.8)	61.5 (67.0)
	Liquid chlorine							615.9	386.4	338.7	106.0 (115.5)	69.2 (75.5)	54.2 (61.8)
	Hypochlorite							9.7	0.0	0.0	9.7 (10.6)	0.0	0.0
	Total	---	---	---	2,900	1,831	1,625	---	---	---	394.0 (429.5)	654.4 (713.3)	581.6 (633.9)

Note：The exchange rate between soum and USD is 1090 soum/USD applied for the rate in Dec.2004,chemical price by USD is same with the price for LTDP

9.2 Organizational Arrangement

9.2.1 Staff Rearrangement in Vodokanal

As was explained in detail in the previous sections, one of the expected results of the Project implementation is the reduction by approximately 850 of the number of operational personnel. However, this cut of the staff may not pose to be a problem of significance for Vodokanal or for the City, because the staff reduction is going to be gradual within the period of the Project's implementation. There will also be a number of new employment opportunities for the staff who would be retired, dismissed or resigned, such as:

- It is expected that the natural attrition in Vodokanal due to retirement will account for about 200 people by 2010 (see Table 5.8.1). Some of the positions which the retiring personnel are occupying are to be abolished, while the others are to be retained. Thus, there would be what we can call a simultaneous reduction of personnel and positions and the dismissed operational staff would get to fill-in the vacated positions that have not been abolished;
- Implementation of the Project (construction works) will require additional labor;
- Employment opportunities in the newly established subsidiaries and outsourced companies of Vodokanal will surface from time to time;
- When a large number of new small water pumps are installed in apartment buildings and O & M is transferred from Vodokanal to the respective TSZhs, additional staff will be required by those TSZhs; and
- The positions which are planned to be abolished in the future as a result of the Project's implementation will be known well in advance. Therefore, those employees, who occupy such positions and who do not want, for whatever reason, to be transferred to other available positions in Vodokanal-related companies, will have enough time to find an equivalent job, such as in other communal service enterprises or, in some cases, they can be trained for a new profession.

9.2.2 Project Implementation Arrangement

It is expected that just like all other projects financed by international donors in the City, Tashkent City *Hokimiyat* will have the overall responsibility for the implementation of the Project and would be the borrower of the funds, with the subsequent re-lending to Vodokanal. Accordingly, the following agreements are expected to be concluded: the loan agreement between *Hokimiyat* and the prospective lender, the sovereign guarantee agreement, the re-lending agreement between *Hokimiyat* and Vodokanal and the project implementation agreement between Vodokanal and the lender.

For Project management and implementation, it is a requirement that the Project's executing agency would be established under *Hokimiyat*, namely under its Investments Department. In this case, the whole Project's management organization would be similar to the on-going EBRD Project. Moreover, taking into account that the implementation of this Project is not expected to start earlier than 2007, i.e. when the EBRD Project is designed to be completed, it would be desirable for the new executing agency to be established on the basis of the existing EBRD's Project Implementation Unit. This set-up would allow it to run the Project smoothly from the very beginning since the recruited staff of the executing agency would, by that time, already possess valuable experience in managing another international project for Vodokanal. The executing agency would be assisted by national and international consultants on all aspects of project management and implementation.

Chapter 10 Project Costs and Implementation Plan

Chapter 10 Project Costs and Implementation Plan

10.1 Procurement Plan for Materials

10.1 .1 Necessary Materials and Equipment

The needed materials and equipment for each facility are listed in Table 10.1.1. The main materials and equipment are required to be used for the PSs and the other civil structures, for pipe installation, for pressure and flow regulation system as well as monitoring system. Such materials are the pipes with appurtenances, valves and electrical cables and other materials for installation. The main equipment includes pumps, automatic valves, electrical switch, control and monitoring panels, and instrumentation.

Table 10.1.1 Lists of Necessary Materials and Equipment

Facilities	Equipment and material
Kibray distribution facilities	Pumps
	Pipes with valves
	Electrical equipment
	Instrumentation facilities
Pressure and flow regulation system	Automatic valves
	Instrumentation facilities
Monitoring station	Monitoring system
Pipe replacement and reinforcement	Pipes with valves
Booster PS	Pumps
	Pipes with valves
	Electrical equipment
	Instrumentation facilities

10.1.2 Procurement Plan

For the abovementioned materials and equipment, the Team surveyed current procurement conditions in Tashkent City. The findings are as follows:

- Almost all existing pumps installed in WTPs and PSs were made in Russia. The quality of the old pumps produced before the 1980s was good, however after the collapse of the Soviet Union, the quality has been declining;

- Currently, a local pump manufacturer is producing volute pumps in Chirchik City, nearby Tashkent City, and provides these pumps to many public Water Works in Uzbekistan. However the quality and efficiency of the pumps are so low that the engineers of Tashkent Vodokanal do not want to use them;

- Recently a Germany pump manufacturer, which is one of the biggest pump manufacturers in the world, opened a branch office in the country, and its products are purchased for pump units mainly in apartment buildings;

- Materials of current pipeline of Tashkent Vodokanal were made in Russia, 67% of which are steel pipes and the rest are cast iron pipes;

- Most replacement of pipes are mainly the steel pipes or polyethylene pipes; and the use of cast iron pipes is declining although they were used for 30% of distribution pipes;

- Steel pipes and cast iron pipes with small diameters of less than 200mm are produced in Tashkent City, however the large diameter are imported from Russia. Tashkent Vodokanal lines the steel pipes by itself;

- Polyethylene pipes are produced by a manufacturer in Karshi City in Uzbekistan, which was established by Germany and Uzbekistan companies. Those pipes are used by Tashkent Vodokanal as the replacement for the distribution pipes;

- Valves with diameters of less than 500 mm are made in Tashkent City, however their quality is doubtful. Valves of large diameter and automatic valves will be purchased from Russia for the EBRD Project. Russian valves have broken down frequently because of quality problems in important parts;

- Existing electric equipment and materials were made in Russia. There are a few instrumentation devices for water supply system;

- Electric panels cannot be assembled in Uzbekistan, neither have parts and electrical materials been produced in the country. Basically electric equipment, materials and instrumentation are imported from Germany or Russian;

As the results of the survey, a procurement plan is proposed as shown in Table 10.1.2.

Table 10.1.2 Proposed Procurement Plan

Material/equipment		Produced countries for existing facilities	Proposed procurement countries	Note
Pumps	Volute pumps	Russia/Uzbekistan	European countries/ Japan	
	Pump units	Germany	European countries/ Japan	
Pipes	Steel pipe	Russia	Russia/Turkey	
	Cast iron pipe	Russia	---	Not to be used
	Ductile iron pipe	---	Russia/ Turkey	
	Vinyl chloride/ polyethylene	Russia/Uzbekistan	Russia/ Turkey/ Uzbekistan	For small diameters
Valves	Manual valves	Russia/Uzbekistan	Russia/Turkey	
	Automatic Valves	Russia	Russia/Turkey	
	Automatic valves (For regulation)		European countries/ Russia	
Electrical material/ equipment	High voltage switch gear	Russia	European countries/ Russia	
	Low voltage switch gear	Russia	European countries/ Russia	
	Cable electrical materials	Russia	European countries/ Russia	
Instrumentation facilities		Russia	European countries/ Japan	
Monitoring system		---	European countries/ Japan	Currently no monitoring

10.2 Construction Plan

10.2.1 Contents of Construction

The contents of the construction works are listed in Table 10.2.1. The major works are pipe installation, pump installation with pipe works and electrical works.

Table 10.2.1 Contents of Construction Works

Facilities	Contents of works
Improvement for Kibray distribution facilities	Pipe installation outside
	Pump installation and pipe works in building
	Electrical works
Pressure and flow regulation system	Valve installation on road
	Electrical works
Monitoring station	Electrical works in buildings
Pipe replacement and reinforcement	Pipe installation in the City
Improvement of booster PS	Pump installation and pipe works in buildings
	Electrical works
	Pipe refurbishing outside

10.2.2 Preparation of Construction

In Uzbekistan, strict official procedures are required to be followed for construction works similar to that of the other countries of the former Soviet Union.

The procedures for pipe installation are described as follows:

1) To purchase maps for the targeted roads from the "Tashkent State Institute of Engineering". The cost is 600,000 soum/ km;
2) To ask for a design document from the "Design Authority of Tashkent City" to be able to design for the installation works, or to acquire the evidence that will shows "designed by the Authority". (Some payment for the costs will be required);
3) To apply the design for the evaluation by "Evaluation Authority for Construction" (Some payment for the costs will be required);
4) To get permission for construction by having "Permission Authority for Construction" (Payment of 0.1% of construction costs will be required);
5) To get permission for the road occupation from "Tashkent City Traffic Authority"; and

6) After construction completion, drawings of the installed pipes need to submit to "Tashkent State Institute of Engineering". The pipes will be integrated into the Digital Map of Tashkent City.

The procedures for construction works, such as rehabilitating and repairing the PSs, are described as follows:

1) To acquire the evidence that indicates designed by "Design Authority of Tashkent City". (Some payment for the costs will be required);
2) To apply for evaluation from the "Evaluation Authority for Construction" (Some payment for the costs will be required);
3) To apply for permission for construction from the "Permission Authority for Construction" (Payment of 0.1% of construction costs will be required); and

10.2.3 Construction Plan

(1) Construction Work at Kibray WTP and in Buildings of Booster PS

There are no restrictions with regard to traffic or by the residents at surrounding area for renovation works at Kibray WTP and in the buildings of the booster PSs. However since these facilities are utilized for water distribution, the rehabilitation and repair works should, as much as possible, be carried out with minimum disruption to the water distribution.The detailed working plan for the rehabilitation and repair of the facilities should be planned ahead of time in close coordination with the Vodokanal Staff.

(2) Replacement of Deteriorated Distribution Pipes and Reinforcement Pipes

A total of 420km of deteriorated distribution pipes will be replaced, while approximately 17km of reinforcement pipes will be installed under the Project of F/S. Since most of the pipes are located in residential areas, population densities are so, and water consumption is high. Vehicular traffic is also concentrated in these areas. Therefore, countermeasures to mitigate traffic congestion and preventing accidents, e.g. limiting working time, preparing of detour streets, and preventing long hours of water interruption, need to be prepared. It is also important to provide proper information to the residents before any work is started.

In the City the groundwater level from the ground surface is low, and the soil is of the hard type. Therefore, most excavations for pipe installation must be carried out by the open cutting method without sheet piles. However, since the ground water level of some areas, such as Sergeli District, is very high (GL-0.5m), utilizing sheet pile shall have to be considered for safety reasons.

Vodokanal has continuously implemented replacement works, and therefore replacement work should be executed on its own initiative. The Chief Engineer of Vodokanal declared that annually, the length of pipelines to be installed is going to be limited to 60km including the pipe reinforcement.

(3) Electrical Works

The repair and rehabilitation for electrical works should also be implemented with minimal disruption of water distribution services and the improvement of pump facilities and pipes. The electricity works is composed of the installation of instrumentation facilities including the setting up of data input, and the system start-up. For this work, experts will be necessary, and some of the highly-skilled Vodokanal engineers should be trained by the experts to effectively operate the system.

10.3 Project Costs

10.3.1 Construction Costs

(1) Improvement for Kibray WTP

The costs of improving the Kibray WTP (F/S components) are shown in Table 10.3.1. Although the installation of flow meters for Kadirya and Kibray WTP should be included in the F/S, since this has already been decided to be installed in 2005 by Vodokanal. This is not included in the Table.

Table 10.3.1 Costs for Refurbishing for Kibray WTP

Facility		Specifications	Value	Unit	Unit price	Cost (USD)	Remarks
Pipe refurbishing		D2000	100	m	1,500	150,000	
		D1400	1,500	m	800	1,200,000	
		Valves and others 30%	1			405,000	
Sub-total						1,755,000	
Distribution P/S	Pump	500m^3/hx40mhx90kW	4	---	10,741	42,964	2stand-by
	Installation	40%	1	---		8,593	
	Pipe/valve	100%	1	---		42,964	
	Electrical works		1	---		124,000	
	Building	Repair	1	---		50,000	
Sub-total						268,521	
Total						2,023.521	

(2) Replacement of Distribution Pipes

The costs for the replacement of distribution pipes selected by Vodokanal are shown in Table 10.3.2.

(3) Improvement of Booster PSs

The costs for improving, repairing and rehabilitating the booster PSs are shown in Table 10.3.3.

(4) Improvement of Distribution Network

The costs for improving the distribution network are shown in Table 10.3.4.

(5) Total Construction Cost

The total construction costs are shown in Table 10.3.5.

Table 10.3.2 Costs for Replacement of Distribution Pipes

Facility	Equipment	Specifications	Value	unit	Unit cost (USD	Cost (USD)	Remarks
Small diameter VP	VP pipe	VP150	74,263	m	19	1,410,997	
		100	179,559	m	10	1,795,590	
		50-75:100	31,387	m	10	313,870	
	Valve & fitting		50	%		1,760,229	
	Installation		285,209	m	45	12,834,405	
	Sub-total	Sub-total	285,209	m		18,115,091	
Middle diameter ductile iron pipe	Ductile iron pipe	DIP 600	25,653	m	170	4,361,010	
		500	3,150	m	127	400,050	
		400	10,738	m	90	966,420	
		300	52,933	m	60	3,175,980	
		250	7,250	m	50	362,500	
		200	20,658	m	38	785,004	
	Valve & fitting		30	%		3,015,289	
	Installation		120,382	m	60	7,222,920	
	Sub-total		120,382			20,289,173	
Large diameter steel pipes	Steel pipes	1,200	750	m	400	300,000	
		1,000	500	m	280	140,000	
		900	7,300	m	235	1,715,500	
		800	1,740	m	190	330,600	
		700	4,200	m	170	714,000	
	Valve & fitting		30	%		960,030	
	Installation		14,490	m	200	2,898,000	
		Sub-total	14,490			7,058,130	
Total			420,081	m		45,462,394	

Table 10.3.3 Costs for Improvement of Booster PSs

Facility	Equipment	Specifications	Value	unit	Unit cost (USD)	Cost (USD)	Remarks
Mirzo-Ulugbek	Main pump	900m^3/hrx50mhx 180kW	5	---	40,000	200,000	2stand-by
	Installation	30%	1			60,000	
	Pipe/valve works	100%	1	---		200,000	
	Electrical works		1	---		650,000	
	Building	W8mxL25m	200	m^2	800	160,000	
	Instrumentation	Flow/level meter	1	---		170,000	
	Sub-total					1,440,000	
Others	Installation of monitoring facilities for PS	Chilanzar PS	1	---		200,000	
		Q=3000m^3/hr	4	---	180,000	720,000	
		Q=1000m^3/hr	6	---	48,000	288,000	
	Refurbishing of PS	(Q=1000-600m^3/hr	30	---	120,000	3,600,000	
		Q=500-300m^3/hr	3	---	85,000	255,000	
		Q=200-100m^3/hr)	3	---	70,000	210,000	
		Q<100m^3/hr	9	---	25,000	225,000	
	Pump units	a	43	units	4,737	203,691	
		b	22	units	6,633	145,926	
		c	19	units	8,611	163,609	
		d	6	units	8,611	51,666	
		e	16	units	8,611	137,776	
	Unit installation	30% for units	1	---		210,800	
	Pipe refurbishing	25%	1	---		1,546,617	
	Sub-total		1	---		7,958,086	
Total						9,398,086	

Table 10.3.4 Costs for Improvement of Distribution Network

Facility	Equipment	Specifications	Value	unit	Unit cost (USD)	Cost (USD)	Remarks
Monitoring facilities	Monitoring station	In Vodokanal Head-office	1	---		286,700	
	Monitoring station	Located in Kara-su	1	---		140,000	
	Sub-total					426,700	
Reinforce for pipes	Steel pipe	D1400	2.8	km	788	2,206,400	
		D1200	8.2	km	674	5,526,800	
		D1000	4.8	km	525	2,520,000	
		D500	1.0	km	301	301,000	
	Sub-total		16.8	km		10,554,200	
Regulation of pressure /flow	Pressure/flow regulation facili-ties	D1600	1		132,400	132,400	
		D1200	4	---	116,600	466,400	
		D1100	1		109,300	109,300	
		D1000	9	---	102,000	918,000	
		D900	2	---	93,900	187,800	
		D600	5	---	81,600	408,000	
	Sub-total		22			2,089,500	
Total						13,070,400	

Table 10.3.5 Total Construction Costs

Name	Facility	Value	Cost (Thousand USD)			Remarks
			Phase 1		Phase2	
			2007-2011	2012-2014		
Kibray WTP replacement and improvement	Pipe rearrangement	1		1,755		
	Distribution PS	1		269		
	Sub-total	1		2,024		
Pipeline replacement	Average 210mm rep.	120km	12,989			
	Average 210mm rep.	120km		12,989		
	Average 210mm rep.	180km			19,484	
	Sub-total	420km	12,989	12,989	19,484	Total: 45,462
Booster PS refurbishing	Mirzo-Ulgbek	1		1,440		
	Other PSs	1		7,958		
	Sub-total			9,398		
Pipeline network improvement	Monitoring facilities	1		427		
	Reinforcement of pipes	16.8km		10,554		
	Pressure regulation valves	22units		2,090		
	Sub-total			13,071		
A) Total direct cost			12,989	37,482	19,484	Total: 69,955
B) Total imported material cost			6,431	24,459	9,646	
1) Land acquisition cost		---	0	0	0	
2) Administration cost:		1	260	750	390	A) x 2%
3) Engineering services:		1	1,039	2,999	1,559	A) x 8%
4) Phisical Contingency		1	1,195	3,448	1,793	A)-3) x 10%
5) Price contingency (Phase1-1)		1	719			A)-4) x6.1%(2%- 3years)
5) Price contingency (Phase1-2)				3,540		A)-4) x10.4%(2%- 5years)
5) Price contingency (Phase2)					2,636	A)-4) x14.9%(2%- 7years)
6)Import tax		1	514	1,957	772	B) x 8%
7) VAT		1	2,495	7,105	3,741	A)-6) x 20%
C) Total indirect cost			6,223	19,798	10,891	
Grand total A)+C)			76,492		30,375	
Grand Total A)+C), Phase 1 -Phase 2			106,867			

10.3.2 Operation Costs

The costs for operating the facilities are shown in Table 10.3.6.

Table 10.3.6 Operation Cost of Electricity and Chemical

Items	Consumption/number			Cost (1000USD/year)		Unit price
	2002	2011	Unit	2002	2011	
Electricity	274.6	119.5	GW/year	8,238	3,585	30USD/1000kWh
Coagulant	2,582	5,429	ton/year	278.3	585.2	107.8 USD/t
Liquid chlorine	615.9	386.4	ton/year	106	61.8	160 USD/t
Hypochlorite	9.7	0	ton/year	9.7	0	1,000 USD/t
Sub-total				8,632	4,232	
Operators	1,695	847	person	1,017	508	600 USD/person
Total				9,649	4,740	

Note : The exchange rate applied between soum and USD is 1090 soum/USD, the rate in Dec.2004, chemical price by USD is same as that for the LTDP

10.4 Implementation Schedule

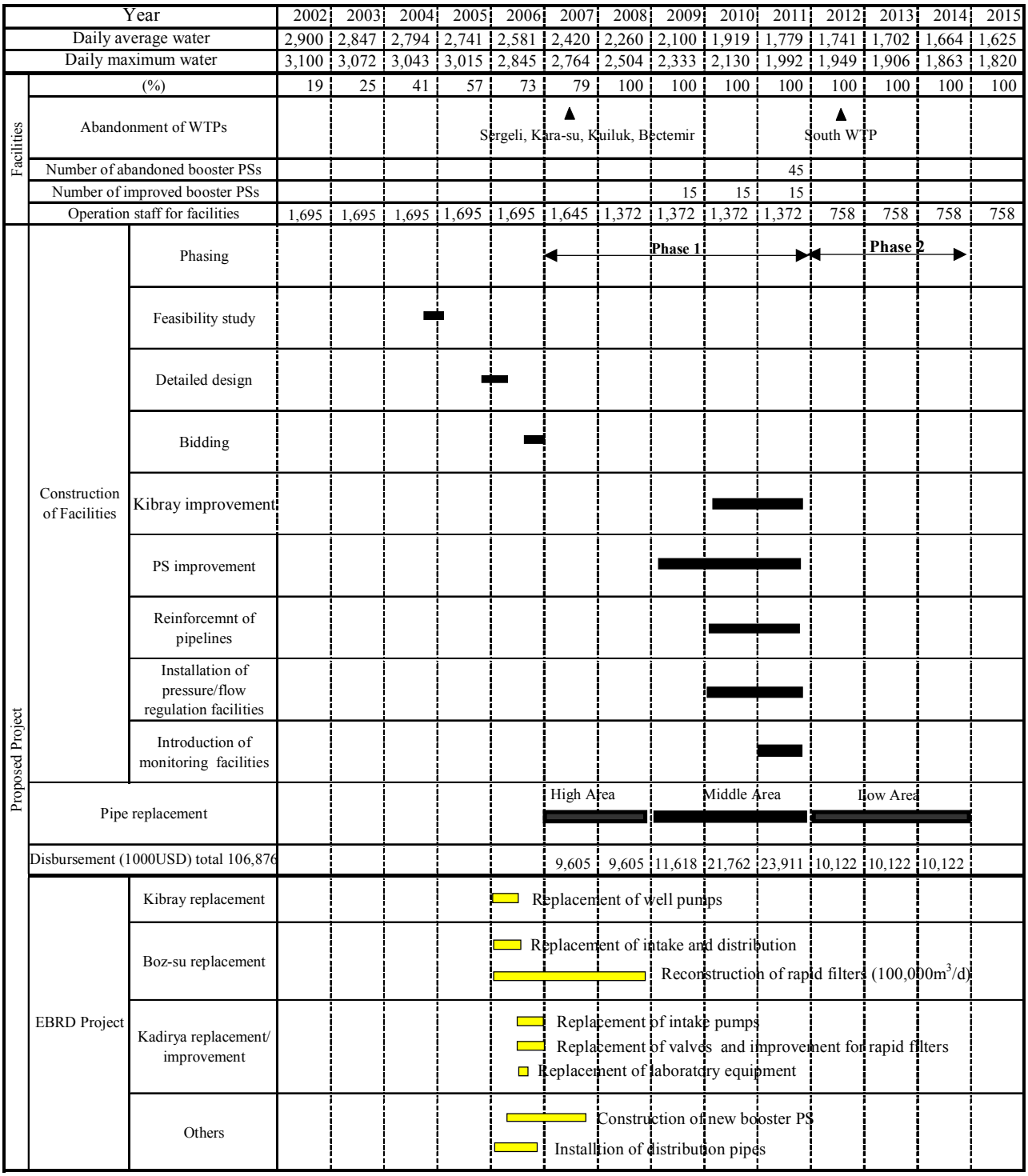
10.4.1 Phasing of the Project

The replacement of deteriorated pipes is a precondition for the implementation of the F/S Project. This is because the move to a gravity distribution system will reduce current water supply. Accordingly the replacement of deteriorated pipelines shall be executed simultaneously with F/S project and the combined Project, which includes the F/S Project and the pipe replacement, is named to be "Highest Priority Project". Vodokanal must secure adequate funding for the pipe replacement work to start early.

The construction period will take eight years, with 60 km of pipelines to be installed annually, for a total of 420 km of pipelines to be replaced. The construction period will be divided into three phases: Phase 1 (2007-2008) will take two years and will entail pipe replacement in the high elevation area. This is the first priority area for pipe replacement. Phase 2 (2009-2011) will take three years and will consist of pipe replacement in the middle elevation area, together with the implementation of the components of the F/S Project. Phase 3 will take another three years (2012-2014) and will involve pipe replacement in low elevation area.

10.4.2 Implementation Schedule

The implementation schedule for the Highest Priority Project is shown in Figure 10.4.1 and is based on aforementioned development plan. The Figure contains the assumptions in reducing water demand, the meter installation ratio for domestic consumers, the schedule for abandoning the WTPs, the number of PSs for F/S, the number of operations staff, and the amount to be disbursed for construction. The schedule of the EBRD project is also shown in the Figure.



Note; If the project cost is financed by foreign donor/bank, import tax and VAT will not be necessary

Figure 10.4.1 Implementation Schedule of F/S Project and Pipe Replacement

Chapter 11 Project Evaluation

Chapter 11 Project Evaluation

11.1 Financial Evaluation

Evaluation of the F/S project together with the pipeline replacement work from financial aspects is presented in this section. Since the F/S project is essential in terms of basic human needs and are not new constructions but generally optimization, replacements and improvements of the existing facilities, Equalizing Discount Rate (hereinafter referred to as "EDR") and Vodokanal's overall financial projection were calculated to evaluate the financial viability of the F/S project with the pipeline replacement.

11.1.1 General Definitions and Assumptions

Before the calculation, incremental benefits and incremental costs should be identified, i.e. differences for benefits and costs respectively, between "With" and "Without" scenarios. The following general definitions were made for the financial evaluation:

(1) "With" and "Without" Scenarios

1) "With" scenario

"With" scenario is the case when the entire F/S project is implemented and the pipeline is replaced. In addition, the EBRD project and meter installation are also assumed to be completed as planned.

2) "Without" scenario

In Tashkent case, "Without" scenario does not mean there are no changes from the current status, but some factors, such as leakage increase and considerable amount of continuous repairs due to insufficient investment and further deterioration of the facilities, will be considered. In this scenario, water production volume will increase as the leakage rate increases in order to meet the water demand. The EBRD project and meter installation are also assumed to be completed as planned because these plans have already been started.

(2) General Assumptions

- Water Demand - Revenue

  In EDR calculations, in both "With" and "Without" scenarios, the water demands are assumed to be the same. Vodokanal will meet the demand and thus, the amount of revenue will be the same in both scenarios. In this connection, tariff increase has no impact on the incremental benefits or costs for EDR calculations;

- Economic Life

  The average economic life of new assets provided under the F/S project was assumed to be 40 years. For the new assets whose economic life is less than 40 years, recurring capital costs are included in EDR calculations;

- The evaluation was carried out in USD at current prices with no adjustments for the effects of inflation and exchange rate fluctuations;

- Since at this moment, the source of the investment fund is unknown, VAT and import duties are included in the total investment cost. These taxes could be exempt when funds are secured from an international financial institution or a foreign government.

(3) Incremental Financial Benefits and Costs

Taking the above definitions and assumptions into consideration, incremental financial benefits and cost are summarized as follows.

1) Incremental Financial Benefits

- There is a difference in the operation cost due to production volume difference, i.e. Production volume difference [m^3/d] x unit production cost (electricity and chemical) [Kwh/m^3 or t/m^3]. Production volume reduction through meter installation is considered as a precondition for both "With" and "Without" scenarios;
- There is a difference in the number of employees due to the optimization of the distribution system and the production volume difference;
- There is a difference in the maintenance/repair cost; and
- There is a difference in energy efficiency due to the optimization of the distribution system, i.e. unit production cost difference [Kwh/m^3] x production volume [m^3/d]. Efficiency improvement by the EBRD project is considered as a precondition for both "With" and "Without" scenarios.

2) Incremental Financial Costs

- The initial capital investment cost of the F/S project and the pipeline replacement work, 100 million USD, excluding price contingency; and
- The recurring capital investment cost of the F/S project equipment, e.g. pumps, control and monitoring equipment, etc.

11.1.2 Financial Evaluation of the F/S Project and the Pipeline Replacement

(1) Result of EDR Calculation with Sensitivity Analysis

Based on the above benefits and costs, an EDR calculation with sensitivity analysis is carried out. As a result, EDR for the F/S project with the pipeline replacement is 9%. For the sensitivity analysis, ±10% in variation is applied to the initial capital cost and the total incremental benefits respectively. The results are summarized below. The details of the calculation is presented in Table S 11.1.1 in Volume 3: Supporting Report.

Table 11.1.1 EDR Calculation Results with Sensitivity Analysis

Benefit / Initial Cost	+ 10 %	Base Case	- 10 %
+ 10 %	9%	8%	7%
Base Case	10%	9%	8%
- 10 %	11%	10%	9%

(2) Evaluation of the Results

In this evaluation, EDR is compared with interest rates of several types of financial source, namely;

1) Commercial Bank: assumed interest rate 10%;

2) International Financial Institution: assumed interest rate 5%; and

3) Foreign government: assumed interest rate 1.3%.

As a result, if Vodokanal could source the funds from an International Financial Institution or a foreign government with less than 5% interest rate, it can be concluded that the F/S project with the pipeline replacement will be financially feasible. On the other hand, if Vodokanal sources the funds from a commercial bank with an interest rate of 10%, it will

not be feasible financially unless investment costs or financial benefit deviate from the base case favorably by approximately 10%.

11.1.3 Financial Impact on Vodokanal's Financial Performance

In this section, financial simulations were conducted for the entire Vodokanal operation based on the F/S project with the pipeline replacement to assess the required tariff increase rate and period by changing the borrowing interest rate. The EBRD project and the meter installation are assumed to be completed as planned.

(1) Assumptions for Financial Simulation

The following assumptions were made for the projections:

1) General Assumptions

- The period of the projections is from 2005 to 2040;
- No adjustments for the effect of inflation and exchange rate fluctuations were considered;
- Meters will be installed for all customers by 2009 as planned by Vodokanal. It is assumed that 25% of meters for apartments will be installed by TKEO;
- Accounts receivable balance is assumed to be 80% of one third of the revenue in the same year;
- Current liabilities balance is assumed to be half of the current assets balance less cash;
- 75% of the entire cash surplus was assumed to be generated from the water supply activity. This ratio corresponds to the ratio between water supply and sewerage costs in 2002; and
- For the EBRD projects, 3.5% per annum is assumed for the interest rate with a 15-year repayment period inclusive of a three-year grace period. Among the total cost estimate of 14.67 million USD, 4.67 million USD is the co-financing part.
- The efforts of Vodokanal for cost reduction and revenue increase are considered;
- Funds will be borrowed from financial institutions at 1.3%, 5%, and 10% interest rates (USD basis) with a 30-year repayment period inclusive of a ten-year grace period;

- The total number of employees of Vodokanal and the spun-off companies was applied in this analysis because the outsourcing cost, which Vodokanal would pay to the spun-off companies, was considered to be equal to the labor costs of the employees reassigned to those companies;
- Personnel required for the implementation of the facilities' Long-Term plan (400 employees) were not included in the total number of employees because they were included in the Capital Investment costs of the facilities' Long-Term plan (Refer to Table 5.8.1 for the details on personnel projection);
- It is assumed that the collection rate for the big debts will be improved in 2007; and.
- Income tax is not considered.

2) Expenses

- The material costs were projected based on the distribution amount;
- The cost of electricity was basically projected based on the electricity consumption. The unit price of electricity was assumed to remain constant;
- The sewerage cost of materials and electricity was calculated based on the ratio between the water supply and the sewerage costs in 2002;
- The labor costs were projected based on the number of employees.
- The meters' acquisition costs were not included in the meters installation costs because the customers are to purchase them; and
- Other sales and administration cost were assumed to remain constant.
- Additional coagulant usage for water quality improvement was added from 2011.

3) Revenue

- Water tariffs in 2005: 30 soum/m^3 for domestic customers and communal services including hot water supply company -Tashteplocentral, and 55.8 soum/m^3 - for industries;
- Sewerage tariffs in 2005: 20 soum/m^3 for domestic customers and communal services including hot water supply company, and 25 soum/m^3 for industries; and

- Charges for sewerage were calculated based on the water supply consumption. The ratio between water supply and sewerage for the first half of 2003 was applied for the calculation.
- It was assumed that as a result of the projects' aim to reduce NRW, it would become clear who are the consumers of 44 thousands m3/day of NRW, and the relevant revenue was added after 2007.

(2) Results of Financial Simulations

1) A Slow Tariff Increase scenario

Table 11.1.2 presents the results of the financial simulation in which the borrowing interest rate was changed, the affordability for domestic customers is fully considered and a Slow Tariff Increase scenario, which assumes the annual tariff increase of 3% from 2006 to 2016, 2025, 2030, and 2040, is adopted respectively.

Table11.1.2 Simulation Results of Slow Tariff Increase, by Interest Rate

Interest Rates	Tariff increase until			
	2016 Cumulative increase: 1.4 fold	2025 Cumulative increase: 1.8 fold	2030 Cumulative increase: 2.1 fold	2040 Cumulative increase: 2.8 fold
1.3%	No cash shortage during 2005 to 2040 Cash surplus of 7 million USD by 2040	No cash shortage during 2005 to 2040 Cash surplus of 130 million USD by 2040	No cash shortage during 2005 to 2040 Cash surplus of 185 million USD by 2040	No cash shortage during 2005 to 2040 Cash surplus of 239 million USD by 2040
5.0%	Cash shortage*	No cash shortage during 2005 to 2040 Cash surplus of 68 million USD by 2040	No cash shortage during 2005 to 2040 Cash surplus of 123 million USD by 2040	No cash shortage during 2005 to 2040 Cash surplus of 177 million USD by 2040
10.0%	Cash shortage	Cash shortage	Cash shortage	Cash shortage

Note: Tariff increase rate (per year): 2006-2040 by 3%

*If tariff increases until 2016, cash shortage will occur after this period (see Volume 3, S11-1-3)

As a result, under a desirable tariff increase rate, if tariffs are increased up to 2016, Vodokanal will be in the most desirable condition from a financial point of view while taking the affordability of domestic customers into account. The details of the simulation under this condition are presented in Table S 11.1.2 in Supporting Report. For the 5% interest, further tariff increase by 3%, until 2025 will be necessary and its simulation details are presented in Table S 11.1.4 in Supporting Report. For the 10% interest rate, either

a further rapid tariff increase or other financial measures such as government subsidy would be necessary, as will be discussed in 2) and 3).

2) Required tariff increase scenario under a 10% interest rate

If Vodokanal borrows the funds at 10% p.a. interest rate, further tariff increase would be necessary. Table11.1.3 shows the required tariff increase if the interest rate increases to 10%.

Table11.1.3 Tariff Increase Trajectory for the Interest Rates of 10%

Interest rate	Annual Tariff Increase				Results
10%	2006 - 2014	2015 - 2019	2020 - 2026	2027 - 2040	Cash surplus of 133 million USD by 2040
	4%	5%	3% Cumulative increase: 2.2 fold	0%	

3) Cash shortages under the Slow Tariff Increase scenario

If any cash shortfalls are to be compensated by the government, tariff increase could be minimized even under a 10% interest rate. Table 11.1.4 presents the results of the calculations of the amount of cash shortages under the Slow Tariff Increase scenario (cf. Table 11.1.2). The simulation details are presented in Table S 11.1.6 in Supporting Report.

Table 11.1.4 Cash Shortages under the Slow Tariff Increase Scenario

Interest rate	Annual Tariff increase				Results
	2005 - 2010	2011 - 2015	2016 - 2020	2021 - 2030	
10%	3%	3%	3%	3% by 2027 Cumulative increase 1.9 fold	Cash surplus of 72 million USD by 2040
Cash shortage for the period (Cumulative)	0	3 mil. USD (3 mil. USD)	20 mil. USD (23 mil. USD)	41 mil. USD (64 mil. USD)	

(3) Conclusion

In order to implement the F/S project and replace the pipeline, a considerable amount of investment funds will be necessary. Even if water charge is increased, it is impossible to secure necessary funds for the recommended plan by Vodokanal alone within the tight

timeframe before implementing the F/S project and replacing the pipeline. Thus, further borrowing or government subsidy will be essential. As the result of the EDR calculation, if the borrowing interest rate is less than 5%, the F/S project with the pipeline replacement will be financially feasible. In this case, however, tariff increase is unavoidable. Table 11.1.5 presents the feasibility of the F/S project with the pipeline replacement and the minimum required financial measures according to the borrowing interest rates.

Table 11.1.5 Feasibility and Minimum Required Financial Measures

Borrowing Interest Rates	Feasibility of the F/S project with the pipeline replacement*	Minimum Required Financial Measures
1.3%	Feasible	Tariff increase by 3% per annum
5%	Feasible	Tariff increase by 3% per annum
10%	Not Feasible*	Tariff increase of more than 3%per annum or Government Subsidy

* Refer to Table 11.1.1

In order to keep the annual tariff increase rate less than 3%, a 1.3% or 5% interest is necessary. If the interest rate exceeds 10%, the projects are not feasible and a more severe tariff increase or a larger amount of government subsidy will be necessary.

The following are some important notes to consider when Vodokanal examines the actual funding plan.

- Since a 1.3% interest rate is almost an unrealistic term, it is unlikely that Vodokanal could secure the funds with such a low interest rate.
- If Vodokanal could borrow the funds from an international financial institution or a foreign government, co-finance, i.e. finance through an Uzbekistan internal fund, which is usually required for a certain amount because the lender will not finance the full amount of the project. In order to cover this co-finance portion of the fund, subsidy from the government or another commercial loan would need to be considered.
- In the financial simulation, income tax is assumed to be exempted during the borrowing period; otherwise, further tariff increase is unavoidable. One of the reasons of this assumption is that the F/S project and the pipeline replacement is rehabilitation project and does not generate extra revenue.

11.2 Socio-Economic Evaluation

Water is one of the Basic Human Needs (hereinafter referred to as "BHN"). In terms of BHN, it is obvious that the F/S project and the pipeline replacement are essential for people living in Tashkent. It is, therefore, in the evaluation of the economic viability, Economic Internal Rate of Return or other indicators are not calculated. Only the economic benefits realized by the F/S project and the pipeline replacement are described in this chapter.

The added values provided by the project after its implementation have been aggregated in the following two groups:

- Public health benefits
- Improvement in living conditions

(1) Public health benefits

The pipe replacements, will bring benefits to public health because the pipes will be cleaner and the water from taps will be cleaner too. In addition, in the "Without" scenario, the water supply facilities will be further deteriorated, which increases risks to public health. Risks to public health lead to potential loss in opportunity costs of labor.

Economic benefit brought by the project is difficult to estimate because the future risks cannot be easily estimated. However, reduction in the risks to public health leads to non quantifiable economic benefits.

(2) Improvement in living conditions

Living conditions will improve for not only the same reasons as above, but also there will be less water stops due to accidents in the distribution system when new pipes are installed.

11.3 Technical Evaluation

The F/S was carried out on the selected prioritized projects mainly composed of activities that would lead to the formulation of an efficient distribution system. In this connection, improvement of the distribution system of Kibray WTP, improvement of distribution network including division of network and pipe reinforcement, installation of automatic pressure/flow regulation facilities, improvement of booster PSs and introduction of monitoring system were planned based on the hydraulic simulation by Water CAD. In addition, the pipe replacement proposed by Vodokanal has also been included in the Study, because this is essential in improving the distribution system.

The Study was carried out by preparing preliminary design, developing O&M policies and procedures, preparing the procurement and construction plans, calculating the project cost, formulating the implementation schedule, and project evaluation. These improvement plans were formulated to save energy, to establish efficient and effective facilities' operation, to have the right mix of required manpower, and to attain minimum construction costs while maintaining conformity with the technical conditions prevalent in Uzbekistan.

With all these taken into consideration, the Project is assessed to be appropriate.

11.4 Environmental Evaluation

The implementation of the Project will not generate any serious environmental problems, since much of the work will focus on improvement works of existing system. However it is anticipated that the construction component of the F/S, particularly the installation of pipe reinforcement, will affect traffic in the City.

The installation of pipe reinforcement will have to be carried out on City thoroughfares. Many of these roads are located inside residential areas, which may not be major roads but are used by the residents. Therefore, detour roads must be prepared when construction on the pipe reinforcement starts, in addition to the preparation of plans to mitigate noise, vibration and dust.

The main roads in Tashkent City are generally wide with a center island, and ample space for sidewalks. If the pipes are installed in either the center island or the sidewalks, then traffic would not be affected. Some roads in residential areas are relatively narrow (around 6 m), but detour roads can be prepared when pipe replacement is done. In addition pipe installation work will not adversely affect the residents along the roads because apartment building and detached houses have buffer zones or setbacks. However, proper planning is required and mitigating countermeasures be put in place before construction works can proceed. Some of these are the construction of detour roads, the selection of proper construction time, and the development of an information dissemination campaign on the Project for the people who would be affected by the construction

In conclusion, since the water distribution system will be improved from technical aspect, there will also be no negative environmental impact to be generated after completion of the project.

Chapter 12 Conclusion and Recommendations

Chapter 12 Conclusions and Recommendations

12.1 Conclusions

The overall goal of the LTDP is to achieve a "stable supply of safe water by 2015" under sustainable management by Vodokanal. To accomplish this goal, the following targets have been set:

- Providing a stable supply of water;
- Establishing self-financed management; and
- Establishing an efficient management organization.

Present Situation in Vodokanal

Firstly, the analysis of the present situation in Vodokanal is shown as follows.

(1) In 2002, NRW in Tashkent city amounted to 1,400,000 m^3/d (per day), and the ratio of NRW in the total production of water of 2,900,000 m^3/d (per day), which totals approximately 48 percent.

(2) In the tariff structure in 2003, 16 percent of individual consumers made the transition to the metered system. However the remaining consumers are still using the norm system, which does not encourage an awareness of water saving.

(3) In regards to the facility, there are eight WTPs (three of which are large-scale operations such as Kadirya, Kibray and Boz-su). Even the most recent facility, which was built in the 1960s, is suffering from serious deterioration, due to a chronic lack of funds allocated to repairs, maintenance and operations.

(4) The PSs in the Kadirya and Kibray WTPs are situated at a higher altitude than the city, and as such, they can employ gravity for their operation. However, the PSs were not designed for such a geographical advantage. Furthermore, it is estimated that the pipelines have ten leakage points per

kilometer per year, due to deterioration.

(5) By the end of 2003, there were 4,695 employees of Vodokanal. Of this number, 1,695 were located within the operations of the facilities, with 1,010 of those located as shift operators.

(6) In order to solve the above-mentioned problems, Vodokanal implemented a project to rehabilitate its facilities, borrowing funds from the EBRD, and attempting to make the transition from the norm system to the metered system, under the tariff system. However, the attempt to change to the metered system has faced delays. In addition to this, Vodokanal does not have a long-term investment plan, due to an inability to insure investment funds.

(7) While increases in the tariff system have been made in the last few years, it is difficult to increase tariffs, due to the living standards of the inhabitants.

(8) As in the above-mentioned, there are many challenges facing Vodokanal. However, as in the case of delays in the transition to a metered system, Vodokanal has not taken adequate measures to solve the problems presented, and needs to have a proper management structure put in place.

Proposed Project Objectives

In response to the above-mentioned problems, the following objectives for the proposed project will be addressed as below.

(1) Current NRW stands at 48 percent. In order to reduce this to 29 percent by 2015, there needs to be an implementation of an NRW Reduction Program, a Rehabilitation Program of Deteriorated Facilities and a Water Distribution Improvement Program.

- NRW Reduction Program concentrates on the replacement of pipelines and the installation of water meters, and the strengthening of management for the NRW.
- The Rehabilitation Program of Deteriorated Facilities will concentrate on looking at water demand. It is estimated that there will be a reduction in water

demand, once other implementations are underway. According to estimates that will be made on the level of that reduction, WTPs will be closed one by one, with an eventual use of only three WTPs, such as Kadirya, Kibray and Boz-su.

- The Water Distribution Improvement Program will improve the pipelines, introduce pressure reduction functions, and improve pump stations which have the ability to use the gravity system, while abolishing others.

(2) By implementing the above-mentioned program necessary operation employees decrease from 1,695 at the end of 2003 by 60 percent, to 631 by 2015. It is also possible to reduce electricity consumption by more than 60 percent, as a result of the rehabilitation and improvement of the facilities.

(3) In addition, USD158 million in construction costs will be required to rehabilitate and improve the facilities.

(4) A large amount of investment funds will be required. Financial simulation was undertaken with regard to the required financial resources for the rehabilitation of the facilities and its repayment scheme. The analysis indicates that if funds are available at an interest rate of below 5% per year, Vodokanal will not have to rely on government subsidy, and so consumers will not be excessively burdened by excessive water tariffs. However, if the interest rate is above 5% per year, it will be a tremendous financial burden for consumers, (especially tariff increases will be sharp). But to avoid such a situation, the government's subsidy might be necessary to reduce the burden for the consumers.

(5) In order to improve the strength of the Vodokonal management system, this study proposes: (i) an improvement in the tariff structure, which takes into the consideration each stage of transition to a metered system, (ii) a management and organizational improvement program, which emphasizes the measurement for effective resolution of problems within this area, making it more sustainable unto itself, (iii) information sharing program, which targeted to share management information and (iv) co-operation program with domestic customers.

(6) The F/S project was formulated on the basis of improving the water distribution system, which is expected to save energy in parallel with the implementation of the plan to reduce NRW and to rehabilitate the deteriorated facilities. The implementation of the F/S project will reduce electricity by 57%, and the number of employees by 50% in 2011. The financial resources and repayment in the F/S project is same as referred in (4). Furthermore, since it is difficult to analyze the profitability of the project by employing the IRR method, the EDR (equivalent discount rate) was more appropriate for the analysis, and the result indicated an EDR of approximately 9%.

12. 2 Recommendations

In order to improve Tashikent's water supply operations in the future, the LTDP proposed in this study should be carried out and ultimately realized. Vodokanal will play a core role in the actual implementation process. Thus, the following recommendations are proposed for Vodokanal and the government.

Recommendations to Vodokanal

(1) It is important to precisely understand the current business situation for the improvement of water supply management in the future as below:

- To understand consumer's propensity to contribute to NRW, such as illegal connections by investigating improper usage;
- To establish facilities (almost all existing facilities are dilapidated) that would be able to provide accurate data on the amount of water at the intake and sent to the WTPs, the amount of water actually being distributed through the system and the water pressure during distribution;
- To utilize data information, collected and analyzed by computers including the quality of water analysis and so on.

(2) In the proposed LTDP, the plan to reduce NRW must be given priority in implementation;

(3) As for the issues that the F/S will not be able to cover, Vodokanal will study and assess these issues;

(4) The importance of daily operation and maintenance activities must be recognized, so a certain portion of the budget must be allocated to maintenance operations;

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(5) In implementing the LTDP, the necessary funds would be 158 million USD for the facility plan and 19 million USD for the management plan. Vodokanal should understand the significance of the plan, have accountability to the government, and seek their cooperation in order to procure the necessary funds;

(6) In implementing the LTDP, setting up of the range and subject matter for the training programs, as well as developing the capacity of the trainers are necessary; and

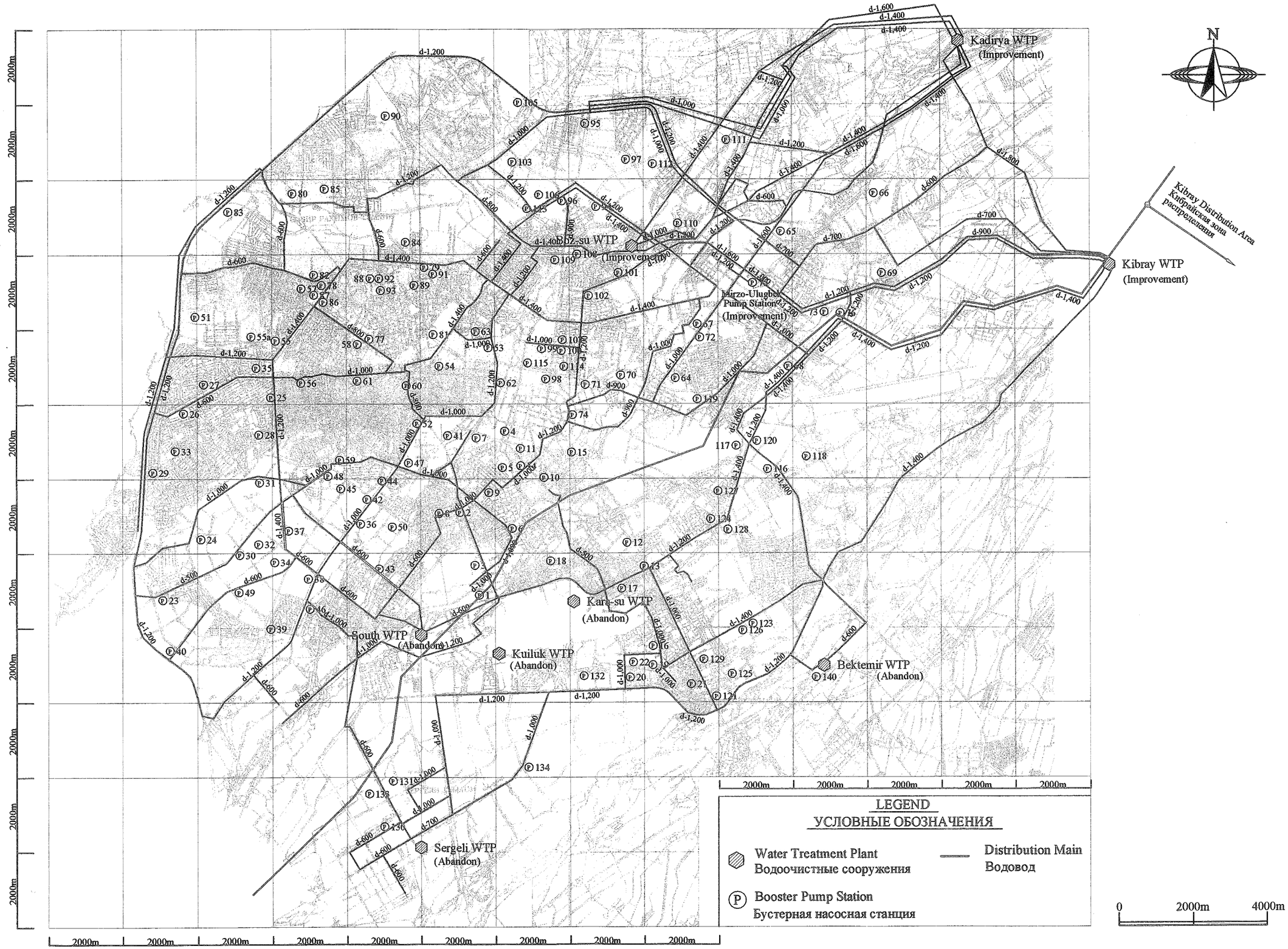
(7) It is vital to get the support of the people through PR activities and increased interaction with the consumers because of the new programs to be implemented that would require tariff increases in the future.

Recommendations to the Government

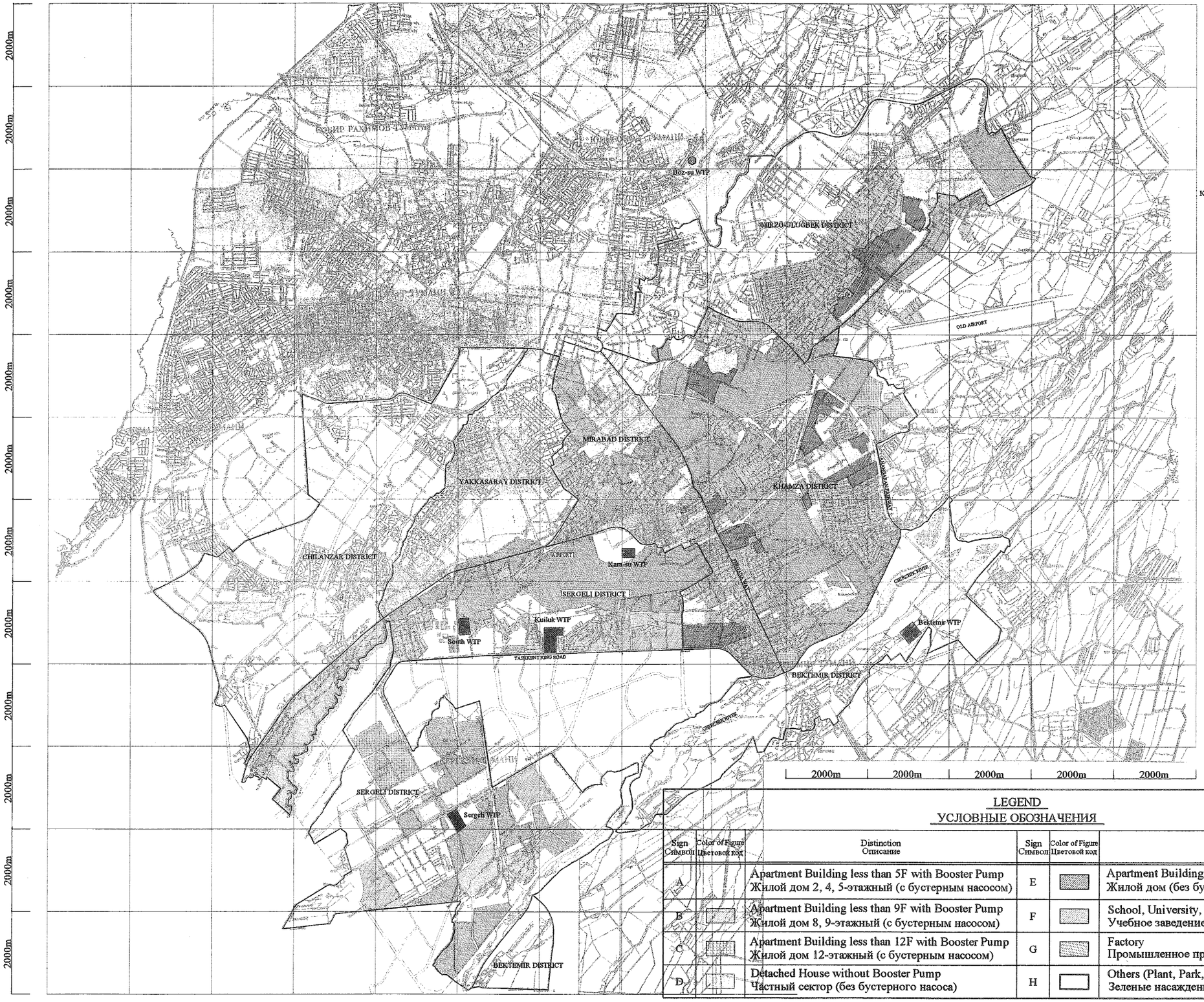
(1) The government should consider its role in assisting this program in regards to issues of salaries for employees and the implementation of the tariff structure, which will make Vodokanal's water supply more stable.

(2) As the water supply is closely related to other public services and is important to the daily life of the population as a whole, it is necessary to ensure the consistency of the LTDP with the plans and programs of the other public services, and that the Government should cooperate in disclosing and providing information on the project.

A. Drawings



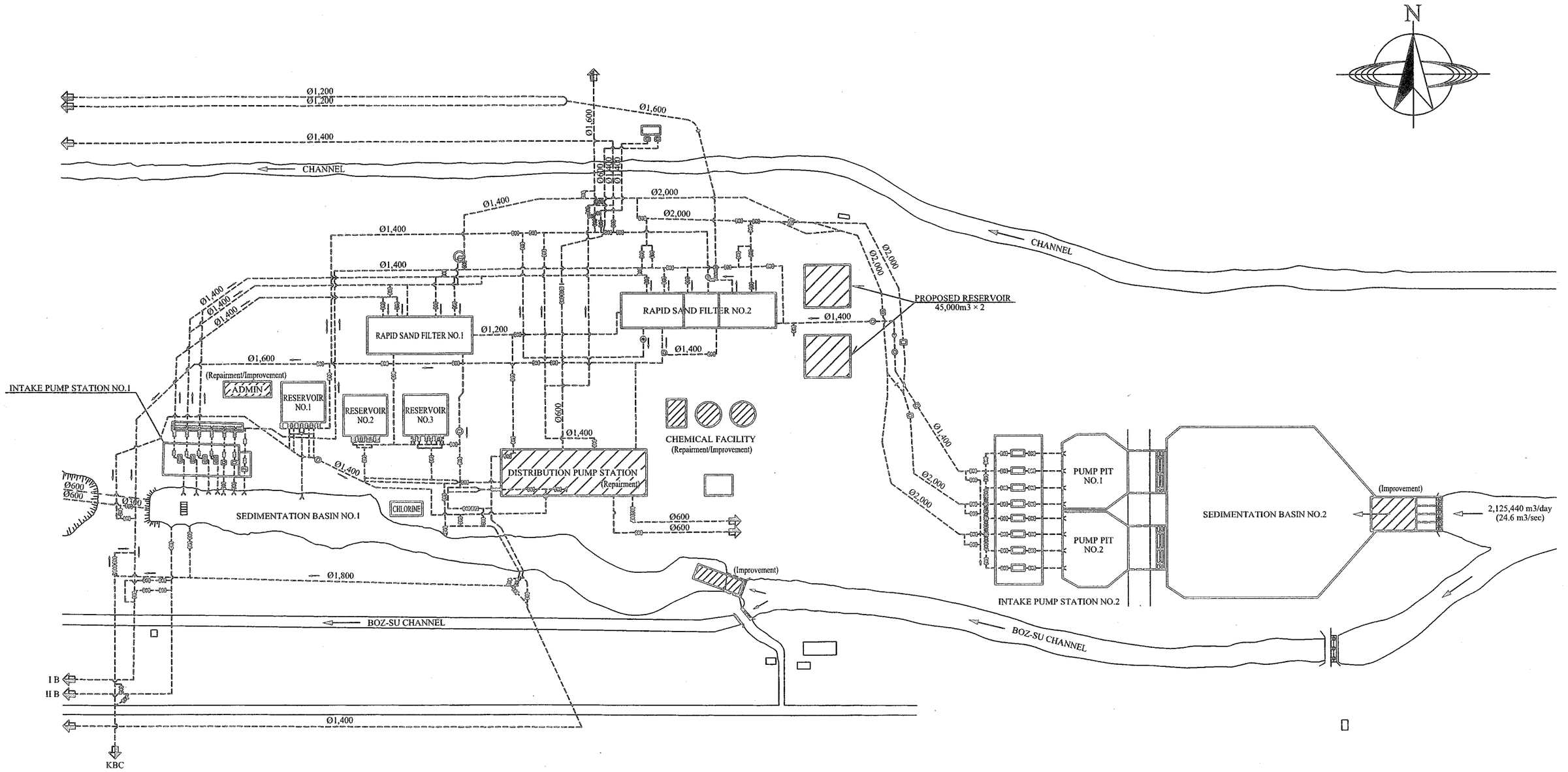
JICA	Japan International Cooperation Agency	ERNST & YOUNG SHINNIHON	NJS Consultants Co., Ltd. Japan	THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY LAYOUT OF WHOLE WATER SUPPLY SYSTEM DRW. NO. A-1 SCALE NON



LEGEND
УСЛОВНЫЕ ОБОЗНАЧЕНИЯ

Sign Символ	Color of Figure Цветовой код	Distinction Описание	Sign Символ	Color of Figure Цветовой код	Distinction Описание
A		Apartment Building less than 5F with Booster Pump Жилой дом 2, 4, 5-этажный (с бустерным насосом)	E		Apartment Building without Booster Pump Жилой дом (без бустерного насоса)
B		Apartment Building less than 9F with Booster Pump Жилой дом 8, 9-этажный (с бустерным насосом)	F		School, University, Hospital Учебное заведение, больница
C		Apartment Building less than 12F with Booster Pump Жилой дом 12-этажный (с бустерным насосом)	G		Factory Промышленное предприятие
D		Detached House without Booster Pump Частный сектор (без бустерного насоса)	H		Others (Plant, Park, Vacant, etc.) Зеленые насаждения, парк, свободная территория

JICA	Japan International Cooperation Agency	ERNST & YOUNG SHINNIHON	NJS Consultants Co., Ltd. Japan	THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY AREA USAGE OF KIBRAY DISTRIBUTION DRW. NO. A-2 SCALE NON



KADIRYA WTP LAYOUT PLAN

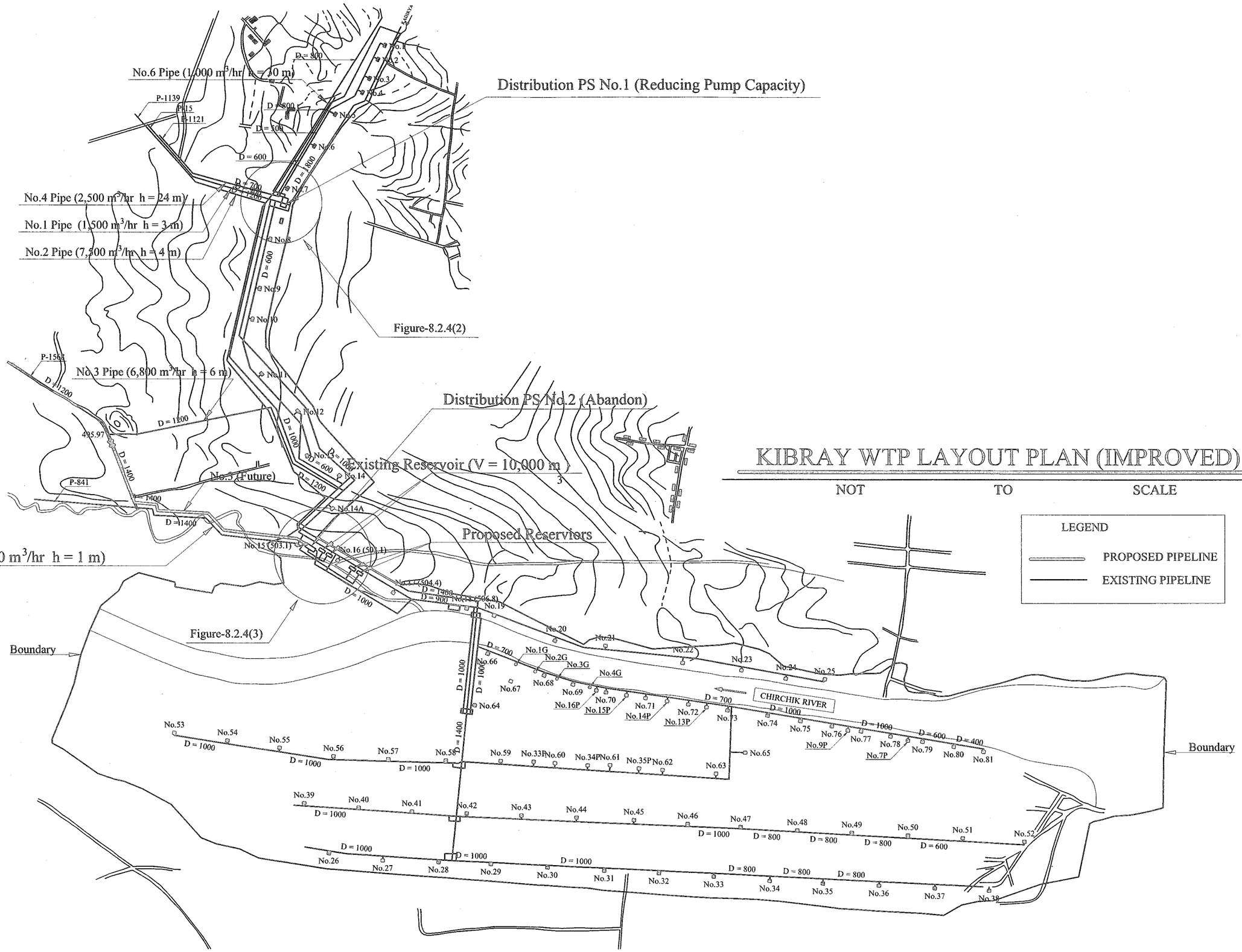
NOT TO SCALE

: Proposed/Improvement/Repairment

JICA	Japan International Cooperation Agency	ERNST & YOUNG SHINNIHON	NJS Consultants Co., Ltd. Japan	THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY	DRW. NO. A-3
				KADIRYA WTP LAYOUT PLAN (Improved)	SCALE NON

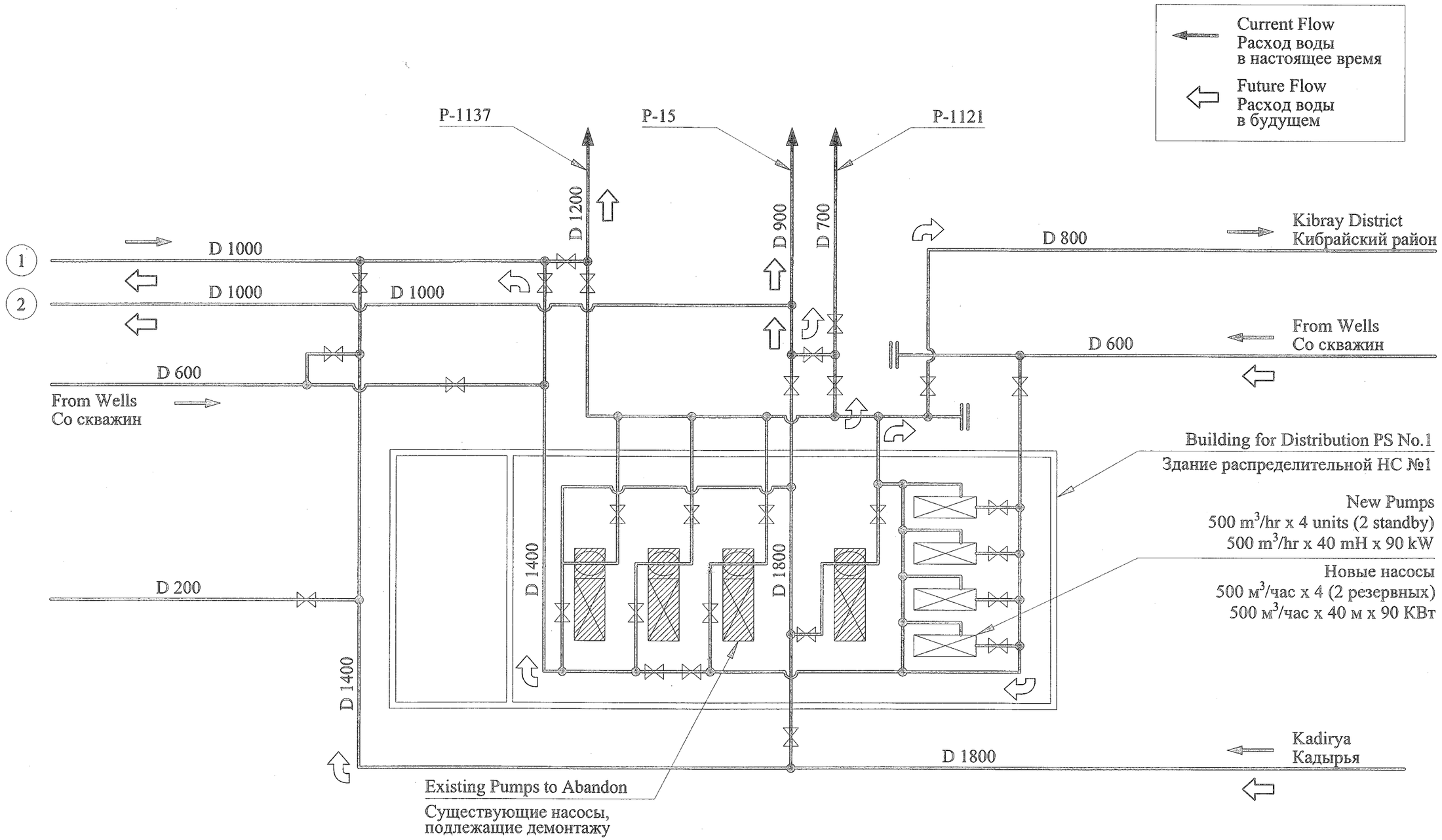
KIBRAY WTP LAYOUT PLAN (IMPROVED)

NOT TO SCALE



JICA	Japan International Cooperation Agency	ERNST & YOUNG SHINNIHON	NJS Consultants Co., Ltd. Japan	THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY KIBRAY WTP LAYOUT PLAN (IMPROVED)

DRW. NO.
A-4
SCALE
NON



KIBRAY WTP IMPROVEMENT PLAN FOR No.1 DISTRIBUTION PS

NOT TO SCALE

JICA Japan International Cooperation Agency	ERNST & YOUNG SHINNIHON	NJS Consultants Co., Ltd. Japan	THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY	DRW. NO.	A-5
			KIBRAY WTP IMPROVEMENT PLAN FOR No.1 DISTRIBUTION PS	SCALE	NON