NO.

THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY IN THE REPUBLIC OF UZBEKISTAN

FINAL REPORT

VOLUME 2

MAIN REPORT

MARCH 2006

Japan International Cooperation Agency
Global Environment Department

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JAPAN INTERNATIONAL COOPERATION AGENCY

TASHKENT CITY MUNICIPALITY
THE REGIONAL COMMUNAL SERVICE ASSOCIATIONS (TKEO)
TASHKENT VODOKANAL (SUVSOZ)
THE REPUBLIC OF UZBEKISTAN

THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY IN THE REPUBLIC OF UZBEKISTAN

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ERNST & YOUNG SHINNIHON

NJS CONSULTANTS CO., LTD.

VOLUMES of FINAL REPORT

"THE STUDY ON RESTRUCTURING OF WATER SUPPLY SYSTEM OF TASHKENT CITY IN THE REPUBLIC OF UZBEKISTAN"

Volume 1 SUMMARY REPORT

Volume 2 MAIN REPORT

Volume 3 SUPPORTING REPORT

Volume 4 DATA REPORT

PREFACE

In response to a request from the Government of the Republic of Uzbekistan, the Government of Japan decided to conduct the Study on a comprehensive rehabilitation and maintenance program for the facilities, as well as implement financial, organizational and institutional improvement plans including a review of the tariff system in Tashkent city and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Akihiro NAKAGOME of Ernst of Young ShinNihon and composed of staff member of Ernst of Young ShinNihon and NJS Consultants, Co., Ltd. to Uzbekistan, four times between August 2003 and March 2006. In addition, JICA set up an advisory committee headed by Mr. Yoshiki OMURA, Japan International Cooperation Agency, between February 2003 and March 2006, which examined the Study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of the Republic of Uzbekistan, and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Uzbekistan for their close cooperation extended to the team.

March, 2006

Ariyuki Matsumoto
Vice-President
Japan International Cooperation Agency

March 2006

Mr. Ariyuki Matsumoto
Vice-President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the final report for "*The Study on Restructuring of Water Supply System of Tashkent City in the Republic of Uzbekistan*".

The Study aims to achieve the effective water supply services in Tashkent City, and the Study Team formulated a Long-Term Development Plan of the water supply services featuring water supply facilities, tariff system and management, conducted a Feasibility Study (F/S) on the priority projects, and shared the expertise with counterpart during the course of the Study and pilot projects.

The water supply services in Tashkent City have confronted a number of difficult issues such as high non-revenue water rate and obsolete water treatment plants. To encounter these issues, the Long-Team Development Plan developed by the Study Team set a goal to achieve three targets stable water supply, self-financial management, and efficient management organization in 2015. Some of the recommendations made by the Study Team have already been incorporated into the policy of Tashkent Vodokanal (SUVSOZ).

We wish to take this opportunity to express the sincere gratitude to the officials of your Agency, the Steering Committee, the Ministry of Foreign Affairs, the Ministry of Health, Labor and Welfare, and Japan Bank for International Cooperation for their kind support and advice. We also would like to show the appreciation to the officials of Tashkent City Municipality, the Regional Communal Service Associations (TKEO), and Tashkent Vodokanal, JICA Uzbekistan Office, and the Embassy of Japan in Uzbekistan for their kind cooperation and assistance throughout the field survey. Finally, We hope that the recommendations of the Study Team will contribute to further improvement of water supply system in Tashkent.

Very truly yours,

Akihiro Nakagome
Team Leader
Study Team for the Study on Reconstructing of Water Supply System of Tashkent City in the Republic of Uzbekistan.

The Study Report
On Restructuring of Water Supply System
Of Tashkent City
in the Republic of Uzbekistan

FINAL REPORT

Glossary
List of Abbreviations
Units of Measurement
Location Map

Feasibility Study

Conclusion and Recommendation

Attachments

Glossary

Terms	Description
Bulk meter	The meter for common use which is installed in the main pipe of an apartment building
Communal Service (Sales) Group	A group in Vodokanal Sales Section which deals mainly with Budgetary Organizations.
Consumption	Amount of water that is served to consumers
Counterpart (C/P)	Tashkent City, TKEO, Vodokanal
GOST	Quality Standard of the former Soviet Union
Government	Tashkent City Hokimiyat, the GOU and/or other governmental authorities
GUPT SUVSOZ	The official name of Vodokanal
Hokim	The City Mayor
Hokimiyat	The City Administration of Tashkent
Norm	The Flat Rate
OAO Tashteplocentral	The water heating company
PO Tashteploenergo	The hot water supply company
Previous Study	The Improvement of Management and Tariff Policy in Water Supply Services in the Republic of Uzbekistan
SNIP	Design Criteria of the former Soviet Union
Study	The Study on Restructuring of Water Supply System of Tashkent City in the Republic of Uzbekistan
Study Team	Study team sent by JICA
Subsozkurilish	New subsidiary for construction separated from Vodokanal
Tashteplocentral	The water heating company
Tashteploenergo	The hot water supply company
TKEO	The Regional Communal Service Associations
TSZh	Tenants Association ('Tovarischestvo Sobstvennikov Zhilja')
Ulgurgisuvsavdo	New sales subsidiary separated from Vodokanal
Uzbek-Zenner	A joint venture company which was established with investment by Hokimiyat and Zenner, a German instrument manufacturer
Uzbekistan	The Republic of Uzbekistan
Uzbekistan Side	The Tashkent City Municipality, TKEO and Vodokanal
Uzkommunhizmat	Uzbekistan Communal Service Agency

Terms	Description
Vodokanal	Water supply company (Tashkent city)
Water CAD	The
ZhEK	The former organization of communal services for domestic customers

List of Abbreviations

Abbreviations	Formal form
ADB	Asian Development Bank
A/P	Accounts payable
BOD	Biochemical Oxygen Demand
CEE	Central and East European
CIA	Central Intelligence Agency
CIS	Commonwealth of Independent States
COM	The Cabinet of Ministers
C/P	Counterpart
CPI	Consumer Price Index
CS	Customer Service
DANCEE	Danish Cooperation for Environment in Eastern Europe
DO	Dissolved Oxygen
EBRD	The European Bank for Reconstruction and Development
EDR	Equalizing Discount Rate
FIRR	Financial Internal Rate of Return
F/S	Feasibility Study
GDP	Gross Domestic Product
GOU	The Government of Uzbekistan
G&A costs	General &administrative costs
HR	Human Resources
IAS	International Accounting Standards
IMF	The International Monetary Fund
IP	Intake Plant
ISO	International Organization for Standardization
IT	Information Technology
JICA	Japan International Cooperation Agency
LAN	Local Area Network
LTDP	Long-Term Development Plan
MM	Man Month
Meth.instr.appr.by Min. of Health of REP.of Uzb.	Methodical instructions, approved by Ministry of Health of The Republic of Uzbekistan
MS DOS	Microsoft Disk Operating System
M/P	Master Plan
NPL	Normal Pool Level

Abbreviations	Formal form
NRW	Non-Revenue Water
ODA	Official Development Assistance
OJT	On-the-job Training
O & M	Operation and Maintenance
PC	Personal Computer
PDCA	Plan, Do, Check, Act
PLC	Programmable Logic Controller
PP	Priority Projects
PR	Public Relations
PS	Pump Station
ROU	The Republic of Uzbekistan
SG&A	Selling, general and administrative expenses
S/T	Sub Total
S/W	Scope of Work
TV	Television
ULG	Ulgurgisuvsavdo
UPS	Uninterruptible Power Supply Unit
USD	United States Dollar
USSR	Union of Soviet Socialist Republics
UZS	Uzbekistan Sum (or Soum) (Uzbekistan's currency)
VAT	Value Added Tax
VOD	Vodokanal
WTP	Water Treatment Plant

Units of Measurement

Abbreviations	Formal form
Bq/l	becquerel per liter
^{o}C	degree Celsius
cm	centimeter
cu.m	cubic meters
GWh/y	Giga-watt-hours/year
ha	hectare
Hr	hour
kgf/cm^2	kilograms force per square centimeters
kg/cm^2	kilograms per square centimeters
km^2	square kilometers
kWh	kilowatt-hours
kWh/m^3	kilowatt-hours per cubic meters
kWh/year	kilowatt-hours per year
l/cap./d (Lpcd)	liters per capita per day
l/s/m	liters per second per meter
m	meter
meq/L	milliequivalent per liter
Mg/L	milligrams per liter
MHz	megahertz
mm	millimetre
m^3	cubic meters
m^3/d	cubic meters per day
m^3/hr	cubic meters per hour
m^3/s	cubic meters per second
$m^3/year$	cubic meters per year
sq.m	square meters
t/d	tons per day
t/y	tons per year
%	percent

Exchange Rate applied in this report

1 USD = 1,000 UZS in 2003 (During the formulation of LTDP in 2003)
1 USD = 1,090 UZS in 2004 (During the investigation of F/S in 2004)
Note: As a reference, the exchange rates for UDS to JPY are shown as follows: in 2003 (1 UDS = 106 JPY) and in 2004 (1 USD = 103 JPY).

The Republic of Uzbekistan

Chirchik River Basin and Tashikent City

Chapter 1 Introduction

Chapter 1 Introduction

1.1 The Purpose of the Report

Water consumption per capita in Tashkent City, Republic of Uzbekistan (hereinafter referred to as "ROU") has reached an enormously high level compared to that of other countries. There are many reasons why the situation persists, but among the more pressing reasons is the tariff structure for water supply services. Firstly, the system of tariff is determined according to family size (so called "Norms"); and secondly, the tariff for water supply services is low. These two factors have encouraged wasteful use of water resulting in a very weak awareness of conserving this precious resource. In accordance with the policy that water supply services should be more self-sustainable, adopted when Uzbekistan became independent, there is an urgent need to transform from the "Norm" tariff system to the metered tariff system, as well as to restructure institutions and organizations of this service. Another consequence is inadequate funds to repair water supply facilities that have become deteriorated, or to make urgent investments in new facilities. To ensure a sustainable water supply service, therefore, it is imperative to plan and implement a comprehensive rehabilitation and maintenance program for the facilities, as well as implement financial, organizational and institutional improvement plans including a review of the tariff system.

Under these circumstances, "The Study for Improvement of Management and Tariff Policy in Water Supply Services" was conducted by Japan International Cooperation Agency (hereinafter referred to as "JICA") in 1999-2000, in response to the request from the Government of Uzbekistan (hereinafter referred to as "GOU"). In this Study, the tariff structure and collection systems were surveyed in terms of compliance with the market economy and the management improvement plan for Vodokanal, a public water supply service company. The legal status of Vodokanal, its obligations and scope of its responsibilities are set in its Charter. Although Vodokanal is under the authority of TKEO (Tashkent Regional Communal Service Association), it is basically a monopoly, being fully owned and controlled by the *Hokimiyat* of Tashkent City. In addition, while its name was

officially changed to "Suvsoz" (Uzbek) in the year 2000, it will still be referred to throughout this report as "Vodokanal" (Russian) for which it is commonly known.

Based on recommendations borne out of the above-mentioned study, the GOU requested Japan conduct a study to formulate a long-term development plan (LTDP)[1] for the renewal and rehabilitation of the existing water supply facilities, and improvement of organizations, institutions and management for sustainable water supply services. Also, GOU requested the conduct of a Feasibility Study (F/S) for the projects prioritized in the LTDP and the sharing of expertise with the GOU counterpart. In response to this request, JICA dispatched a preliminary study team in February 2003, who verified the need to implement the study. Thus, the Scope of Work (S/W) was defined following the decision to carry out this study.

The Objectives of the Study are as follows:

(1) To formulate a Water Supply System M/P (LTDP) towards 2015 for the improvement of water supply facilities inclusive of a tariff system and organizational structure;

(2) To conduct a Feasibility Study (F/S) on projects prioritized in the M/P (LTDP) to evaluate the appropriateness and effectiveness. Action plans will be formulated for organizational, institutional and management improvement; and

(3) To share expertise and provide technology transfers in planning methods and skills for facility rehabilitation and management improvement with counterpart personnel during the course of the Study.

The Study Area mainly covers Tashkent City, the capital of the ROU. The areas in the suburbs of the City where water sources and water treatment plants (WTPs) exist are also included as part of the Study Area. The Scope of the Study is summarized in Table 1.1.

[1] When the scope of work of this project was agreed between TKEO and JICA in 2003, the LTDP was called "master plan (M/P)".

Table 1.1 Scope of Study

Subject	Item	Description
Master Plan	Survey	- Data collection, organization and analysis - Water supply facilities and operation status - Consumer survey, demand survey, employee survey - Organization, institutions and management surveys and questionnaires
	Survey, Training, Awareness Program	- Pilot projects, - Participatory analysis workshop
	Study/Planning	- Water resources wastage, - Management improvement in Vodokanal, - Facilities replacement and rehabilitation
	Evaluation	- Finance, socioeconomic, technical, environmental and general aspects
Project Prioritization	Study	- Identification of technical components - Action plan for management improvement and employee training plan
Feasibility Study	Supplemental Study	- Water quality,
	Feasibility Study	- Facilities replacement and rehabilitation - Improvement of organization, institutions, and management
	Evaluation	- Finance, socioeconomic, technical, environmental and general aspects
Workshop for Technology Transfer	Contents	- Organization, institutions and management - Facilities replacement and rehabilitation

The contents of the Report are as follows: Chapter 2 – 6 will explain the current conditions as well as the issues of the water supply system in Tashkent City, followed by the formulation of the Long-Term Development Plan (LTDP). Prioritized Project Components deriving form the LTDP and the subsequent selection of F/S Project Components are explained in Chapter 7. Selected F/S components are described in Chapter 8–11 with the project costs, the schedule and the evaluations. Finally, conclusions and recommendations will be explained in Section Chapter 12.

Figure 1-1 shows the original schedule of the Study.

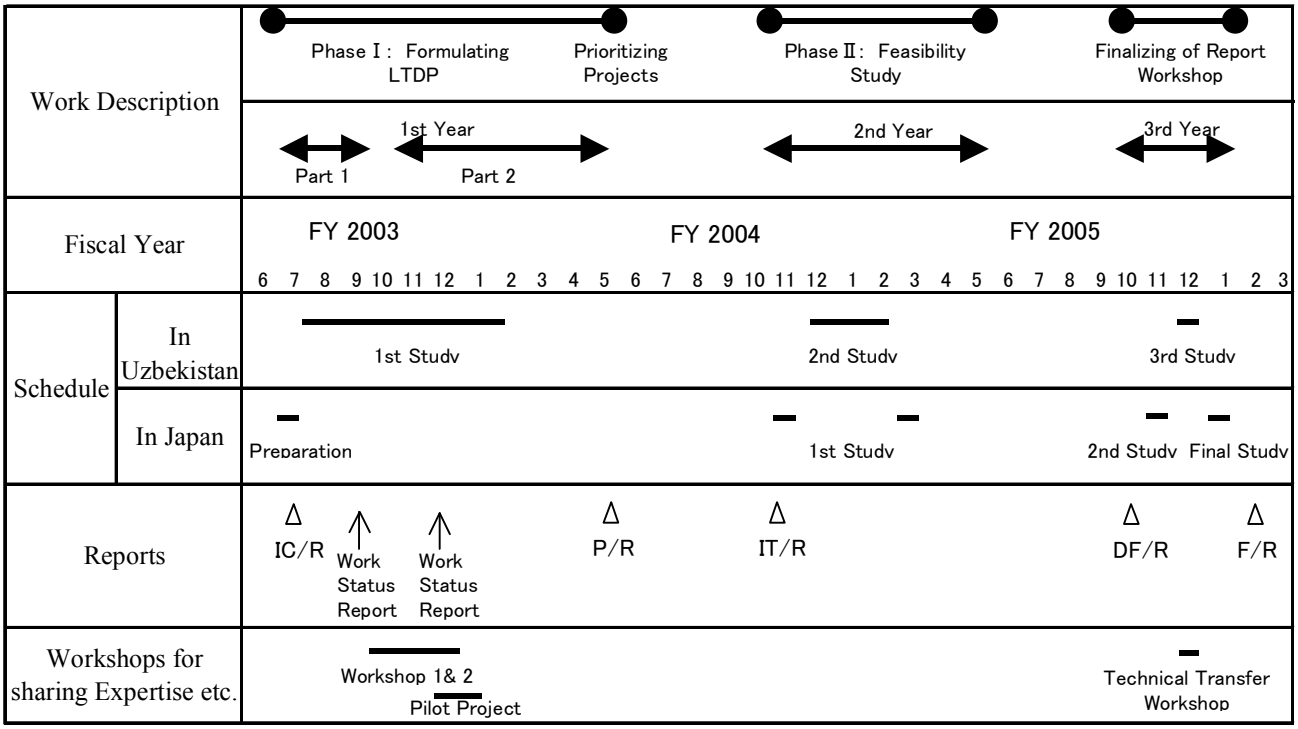

Figure1.1 Original Schedule of the Study (Outline)

1.2 Study Area

The main site to be studied is the Tashkent City, the capital of the Republic of Uzbekistan. Other areas include water sources and WTPs located in the suburbs of the City.

Figure 1.2 The Republic of Uzbekistan

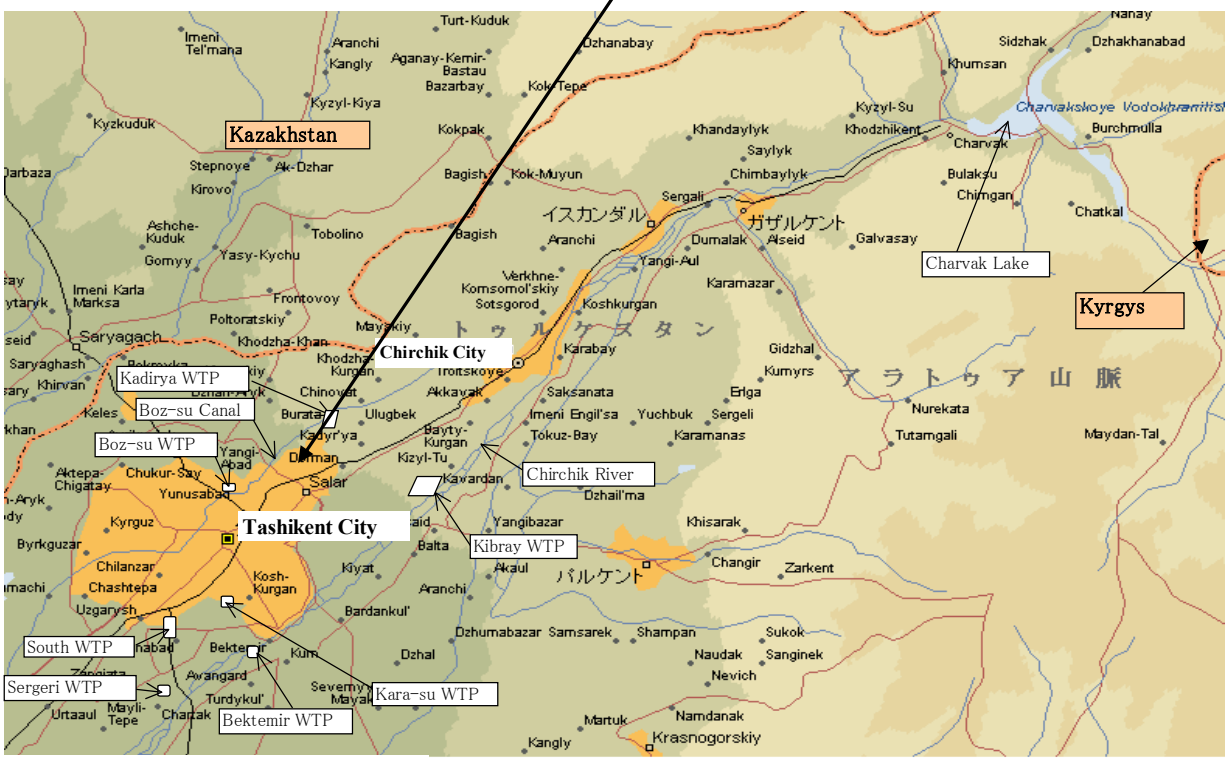

Figure 1.3 Study Area

Chapter 2 Conditions of the Water Supply System

Chapter 2 Conditions of the Water Supply System

2.1 Natural Conditions and Water Sources

2.1.1 Topography, Geology and Meteorology of Tashkent City and the Surrounding Area (Details are referred to S 2.1.1)

(1) Topography

Tashkent City is located in the eastern part of Uzbekistan, only 10kms from the border of Kazakhstan. The northeast side of the City is flanked by the Karajantau Mountain Range, which consists the border of Uzbekistan and Kazakhstan. The City is developed on the complex alluvial plain, formed by the Chirchik River and the Keles River. The City has expanded in a circular form, approximately 20 km in diameter. The northeast area of the City has a higher elevation of 500 m above sea level, the west and south area has a lower elevation of 400 m, and the city center is at 440-450 m.

The Chirchik River basin is the catchments area of the water resource of Tashkent City. The Keles River, on the other hand, originates in Kazakhstan. The Chirchik River starts off from the Taloss Altau mountain range in the central area of Kyrgyz. It is formed when the Chatkal River flows to northeast in Kyrgyzstan, joins with the Oygaing River, and then flows into Uzbekistan. The Charvak Dam is at the confluence of these rivers.

The Chirchik River flows further toward the southwest and merges with the Syr-Daria River approximately 70 kms southwest of Tashkent City. The Tashkent City and its surrounding area are shown in Figure 2.1.1.

(2) Geology

The bedrock of Tashkent City is formed by the sedimentary rock from the Triassic period of the Mesozoic to Neogene eras. From the Triassic to the Crataceous periods of the Mesozoic era, mainly sand stone and mudstone with conglomerate and breccia were formed. The Palaeogene layer is made up of sand stone, mudstone and limestone while the Neogene layer consists of sand stone and mudstone.

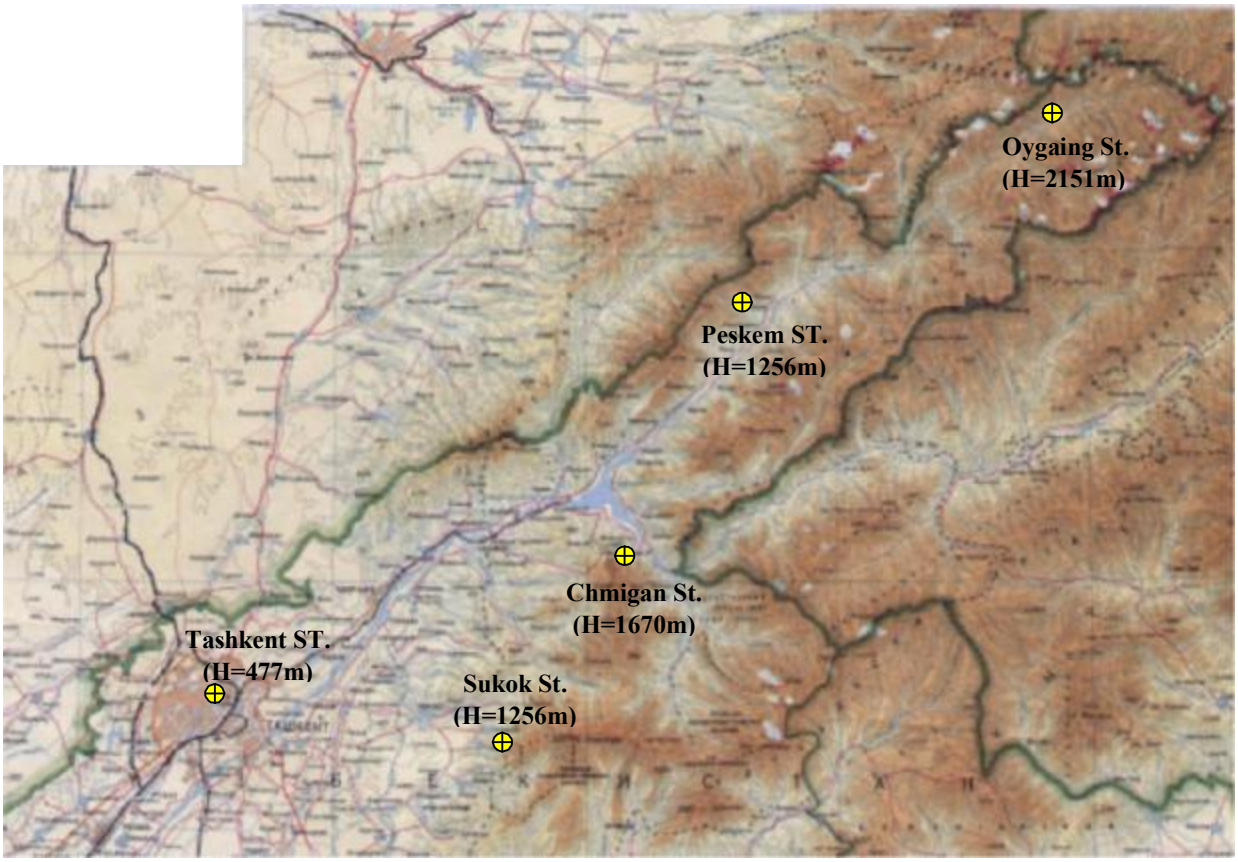

Figure 2.1.1 Surrounding Area of Tashkent City

Covering the Palaeogene and Neogene layers is the unconsolidated deposit of Quaternary layer that is spread out thickly, to a maximum thickness assumed to be several hundreds meters. The Quaternary layer is divided into four sub-layers, and each layer forms a geographical layer corresponding to an accretion period.

The sand gravel layer accumulated during the Pleistocene period of the Quaternary era is distributed in the upland, and another sand gravel layer accumulated during the Holocene period of the Quaternary era is also widely distributed in the lowland along the Chirchik River.

Additionally, several active faults that cut the Quaternary layers cross the city. The geology map surrounding Tashkent City is shown in Figure 2.1.2.

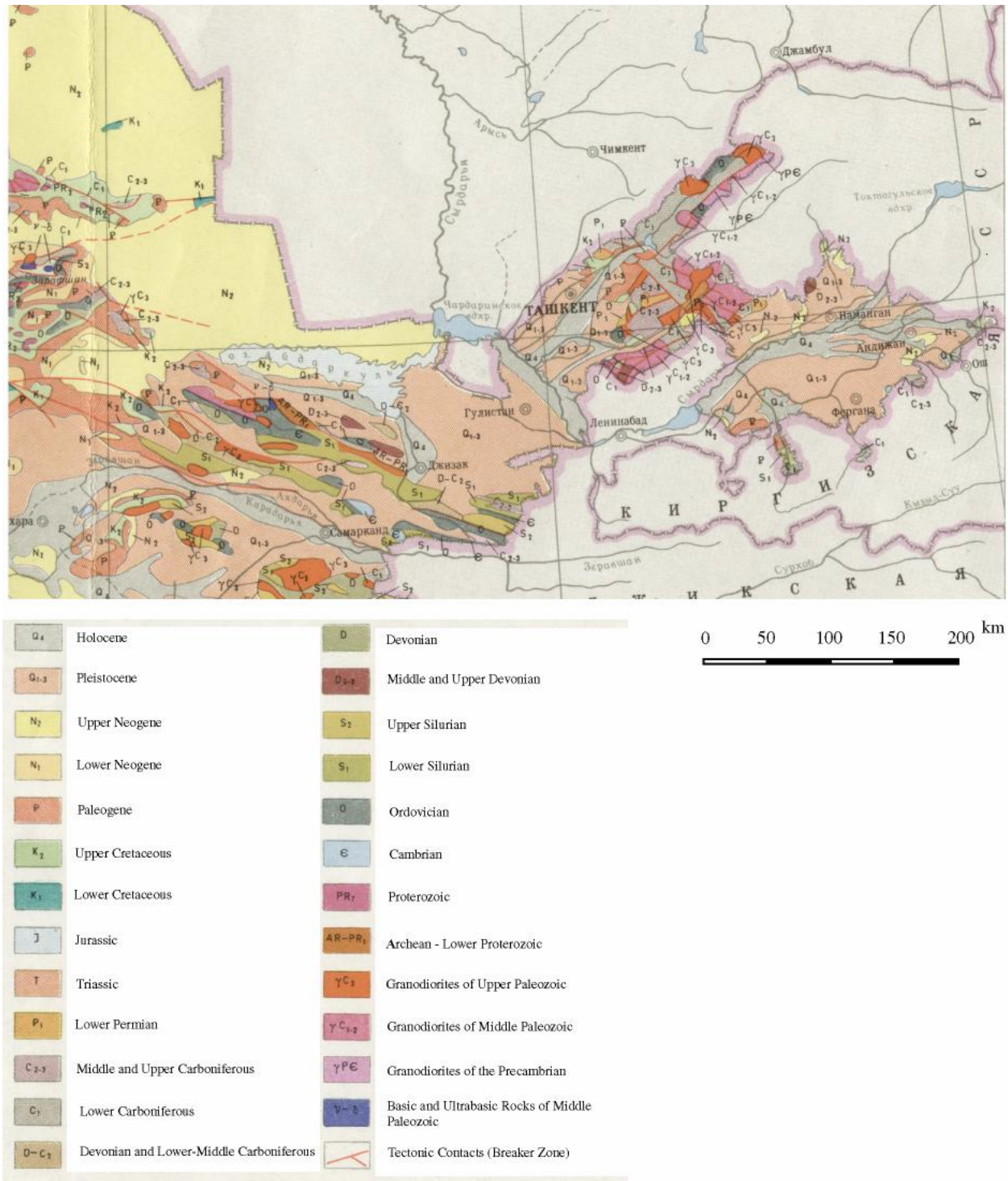

Figure 2.1.2 Geological Map of Northeastern Uzbekistan
(Source: Central Asia Hydrometerological Institute)

(3) Meteorology

There are five operating meteorological gauging stations in the Chirchik River Basin, as shown in Figure2.1.1. Shown in Table 2.1.1(1) to 2.1.1(4) and Figure 2.1.3(1) to 2.1.3(3) are the average value of monthly temperature and precipitation between 1980 and 2002,

the maximum monthly snow depth between 1980 and 1990, and the potential evapotranspiration calculated by "Thorn Weight formula"[*1] based on temperature.

*1: $Et=1.6(10T/I)^a$ Et: Potential evapotranspiration (cm/month),
T: Monthly average temperature(℃) ,
$I=\sum_{i=1}^{12}(Ti/5)1.514$, $a=(492390+17920I-77.1I2+0.675I2)x10-6$

Table 2.1.1(1) Monthly Average Temperature in the Basin of the Chirchik River (Unit: ℃)

Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave.
Tashkent	1.9	3.0	8.6	15.5	20.3	25.7	27.8	26.1	20.0	13.5	8.4	3.9	14.6
Sukok	0.1	0.5	4.3	11.2	15.6	20.9	23.1	22.3	17.6	11.1	6.7	2.6	11.3
Chimgan	-2.9	-2.4	1.4	8.1	12.8	18.2	19.7	19.2	15.4	8.8	4.0	-0.6	8.5
Pskem	-2.9	-1.9	2.6	10.0	14.2	18.6	21.9	21.5	16.6	9.8	4.2	-0.1	9.5
Oygaing	-9.9	-9.1	-4.9	1.3	7.3	11.8	14.9	15.5	10.7	3.5	-2.6	-7.6	2.6

(Source: Tashkent Hydro-Geological Institute)

Table 2.1.1(2) Monthly Precipitation in the Basin of the Chirchik River (Unit: mm)

Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Tashkent	50.7	60.7	69.1	60.2	41.9	13.4	4.4	1.2	6.5	27.6	41.5	53.2	430.6
Sukok	82.1	97.7	138.2	137.9	94.6	25.6	12.0	3.7	14.6	54.6	86.2	99.0	846.2
Chimgan	77.7	92.3	110.3	130.3	100.6	31.9	21.3	7.3	17.6	73.7	92.1	97.3	852.5
Pskem	87.8	96.5	95.3	112.5	77.2	35.7	24.7	11.6	23.1	74.6	98.9	111.0	849.0
Oygaing	61.6	70.2	71.9	91.9	72.3	46.1	35.0	21.5	24.6	72.5	80.6	82.3	730.4

(Source: Tashkent Hydro-Geological Institute)

Table 2.1.1(3) Monthly Maximum Snow Depth in the Basin of the Chirchik River (Unit: mm)

Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Tashkent	7	7	2	0	0	0	0	0	0	0	0	4
Sukok	27	28	16	2	0	0	0	0	0	1	4	11
Chimgan	57	70	67	15	1	0	0	0	0	1	7	14
Pskem	60	77	66	4	0	0	0	0	0	0	11	33
Oygaing	102	126	141	107	25	0	0	0	0	6	35	63

(Source: Tashkent Hydro-Geological Institute)

Table 2.1.1(4) Monthly Evapotranspiration in the Basin of the Chirchik River (Unit: mm)

Name	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Tashkent	51	55	46	-3	-68	-148	-181	-155	-83	-16	24	47	-433
Sukok	82.1	97.7	138.2	137.9	94.6	25.6	13.2	3.8	16.0	54.6	86.2	99.0	848.9
Chimgan	82	96	111	99	30	-77	-109	-111	-58	38	82	107	291
Pskem	88	96	86	65	-4	-76	-113	-114	-58	35	86	108	199
Oygaing	62	70	72	78	14	-41	-72	-81	-41	49	80	82	271

(Source: Tashkent Hydro-Geological Institute)

The temperature of each station varies in proportion to the elevations shown in Figure 2.1.3(1). There is slight precipitation in summer, from June to September. Snow precipitation during the winter season accumulates in the mountain area as shown in Table 2.1.1(3).

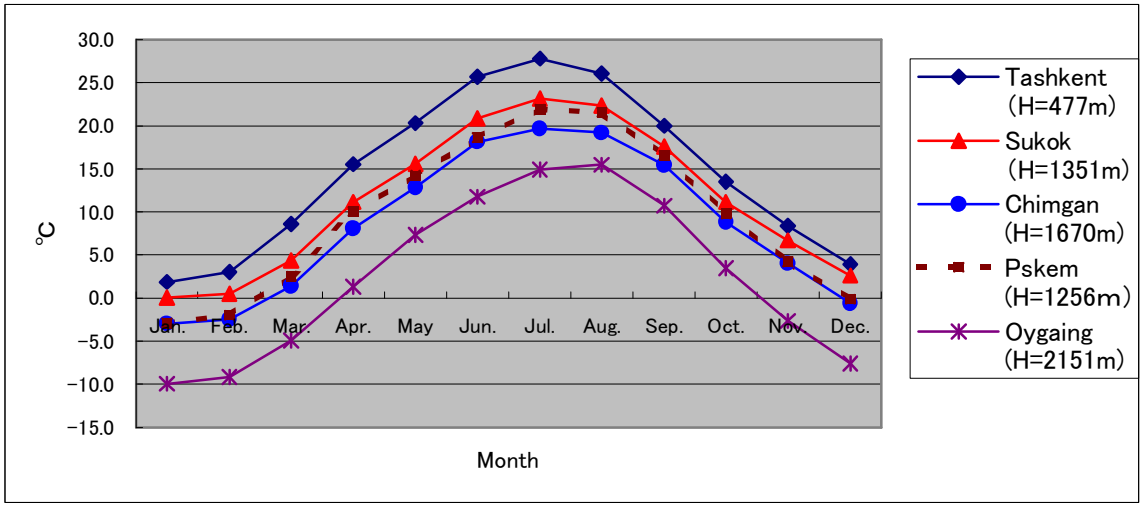

Figure 2.1.3(1) Average Monthly Temperature

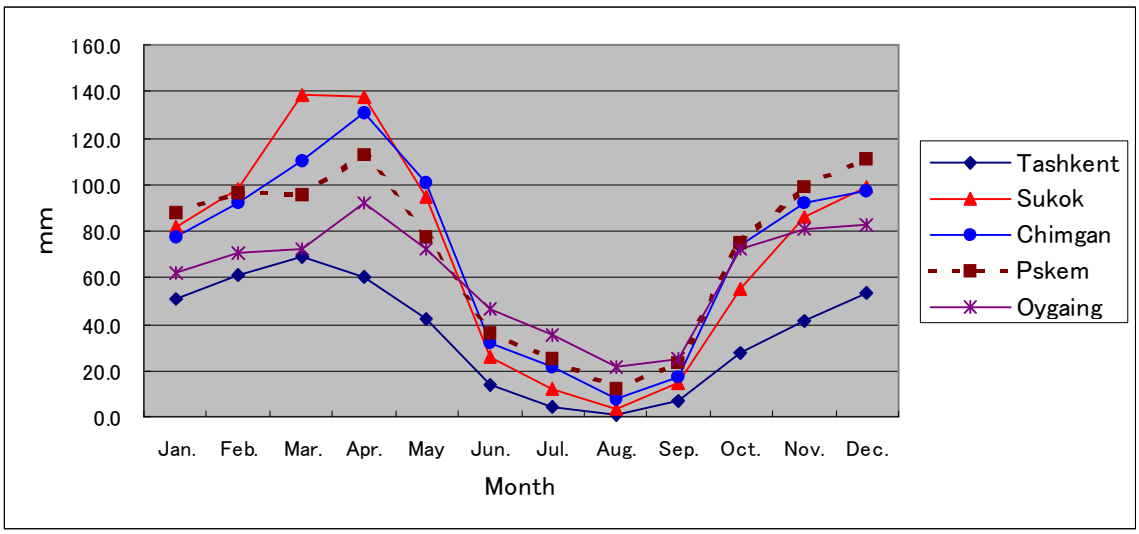

Figure 2.1.3(2) Average Monthly Precipitation

The water recharge balance (precipitation - evapotranspiration) in Tashkent station is negative. Groundwater recharge is not expected in this area.

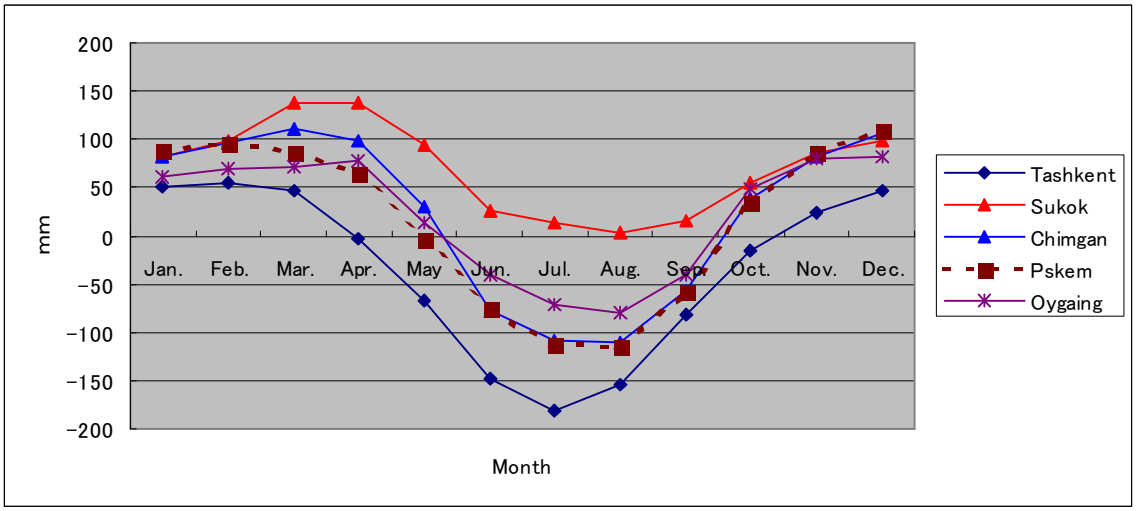

Figure 2.1.3(3) Calculated Monthly Water Recharge Balance

2.1.2 Water Sources for Tashkent City (Details are referred to S 2.1.2)

(1) Outline of Water Sources for Tashkent City

The only water source for Tashkent City is the Chrchik River valley. Construction of the Charvak Dam in 1978 drastically increased the exploitable utilizable water resources in the area, making the valley now one of the most important water sources, not only for Tashkent City, but for the whole of Uzbekistan.

The surface water intake for Tashkent City comes from the Boz-su Canal, while groundwater comes from wells constructed with groundwater intake facilities. Since evapo-transpiration exceeds precipitation in Tashkent City, groundwater recharge cannot be expected in the summer. It is estimated that 60% of the river water discharged from the Charvak dam infiltrates into the underground and recharges groundwater. The average intake quantity for Tashkent City (2 million m^3/day) is around 11% to the total annual discharge amount from the Dam (17.5 million m^3/day) in the recent times.

(2) Charvak Dam and Canal Network in the Basin

The characteristics of the Charvak Dam are shown in Table 2.1.2. The storage volume of the dam is two billion m^3, however the retention time to the average inflow of six billion m^3/year is only around one-third of a year.

Table 2.1.2 Specifications of the Charvak Dam

Specifications	Unit	Value	Inflow/outflow	Unit	Value
Normal pool level (NPL)	m	890	Average year inflow	mil.m^3	6,184
Beginning of operation year	year	1978	1/10 Drought year inflow	mil.m^3	4,551
Embankment height	m	168	1/100 Drought year inflow	mil.m^3	4,008
Catchments area	km^2	10,000	Average year discharge	mil.m^3	6,371
Full storage	mil.m^3	1,991	Drought year discharge	mil.m^3	4,371
Available torage	mil.m^3	1,690	Wet year discharge	mil.m^3	9,645
Surface area at NPL	km^2	40	Average year maximum flow	m^3/sec	470
Average depth	m	49	Average year minimum flow	m^3/sec	90

(Source: Tashkent Hydro-Geological Institute)

The volume is, therefore, not enough to carry a stable water discharge, but the inflow and out flow pattern are similar as shown in Figure 2.1.4. The storage volume of the dam can be utilized to effectively regulate the discharge flow. The storage volume of the dam changes sharply as shown in Figure 2.1.5.

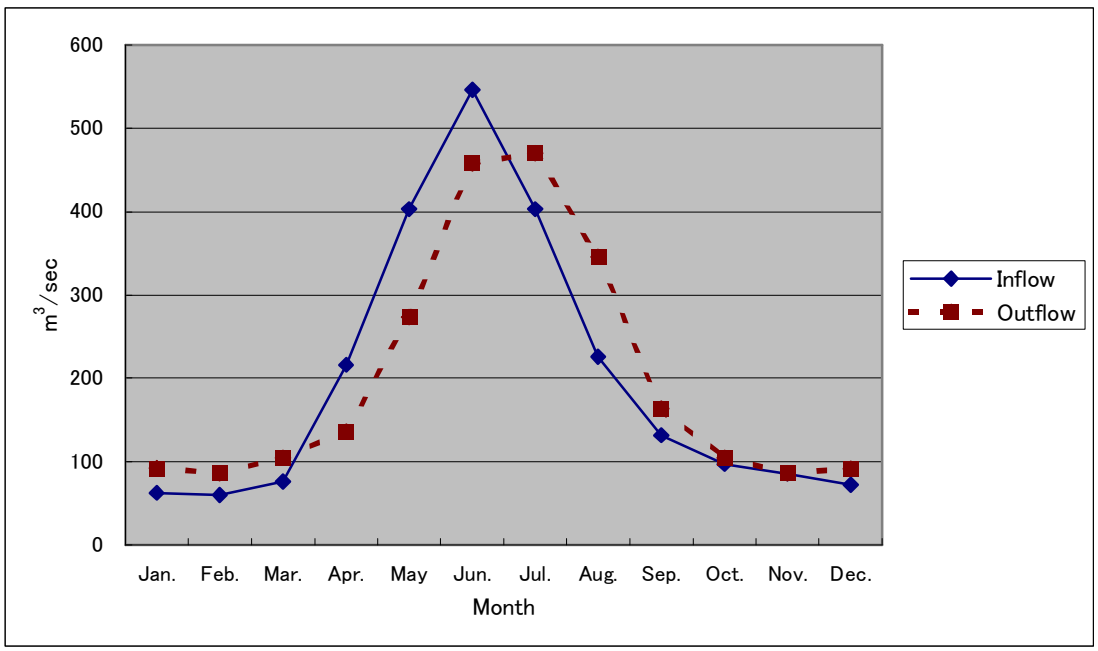

Figure 2.1.4 Average Inflow and Outflow of the Charvak Dam

(Source: Tashkent Hydro-Geological Institute)

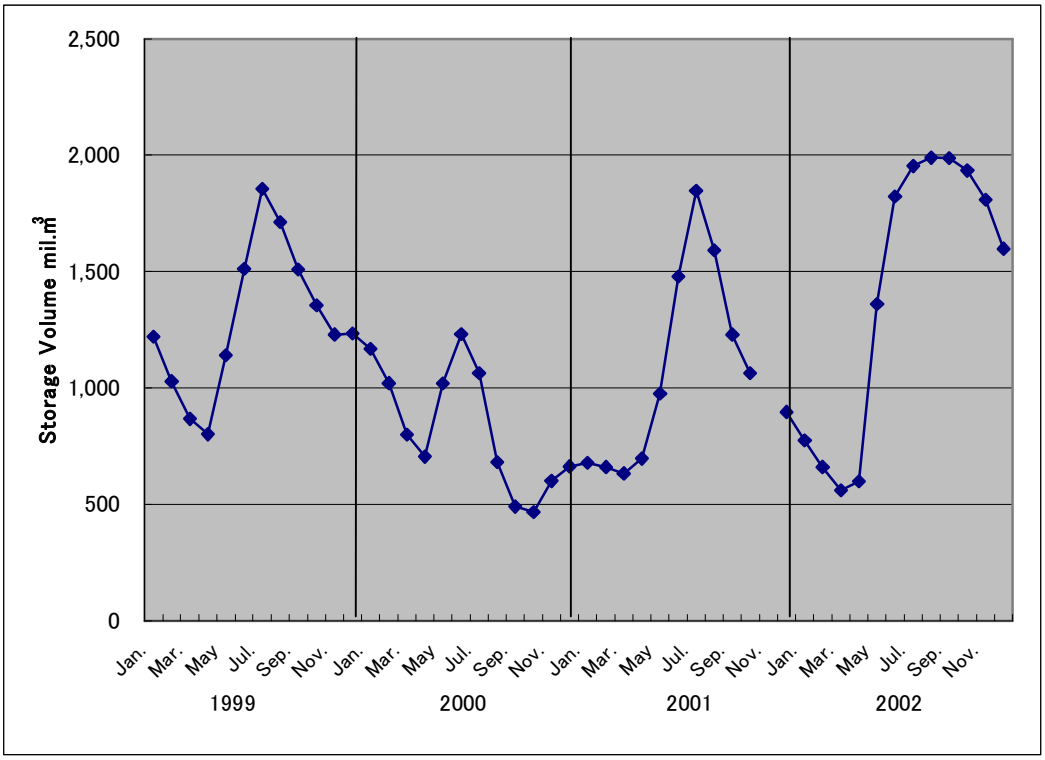

Figure 2.1.5 Fluctuations of Charvak Dam Storage Volume
(Source: Tashkent Hydro-Geological Institute)

Table 2.1.3 shows the water quality of the dam. The lake water looks whitish, and also seems transparent all year round. However, the dam water contains a high concentration of pollutants, such as organic matters (BOD_5), nitrogen (N_{total}) and phosphorus (P_{total}) as shown in the table. In spite of the relatively high concentration of nutrient salt (nitrogen and phosphate), the eutrophication of the lake did not take place until now.

Table 2.1.3 Water Quality of the Dam Lake

Item	Dissolved Solid	Ca^+	$HCO3^-$	Si^+	Fe^+	BOD_5	N_{total}	P_{total}
Range (mg/L)	200-270	40-60	120-160	3.5-9.5	0.06-0.12	0.9-3.2	0.15-0.2	0.02-0.12

(Source: Tashkent Hydro-Geological Institute)

Figure 2.1.6 shows the canal network and the location of hydropower stations. The intake weir for water discharged from the dam is located at Gazalkent, and the maximum 260m^3/sec water flows in the VDK canal, connecting Gazalkent and Chirchik City.Boz-su canal is downstream of the VDK canal with a maximum flow capacity of 85 m^3/sec at the intake point of Kadirya WTP.

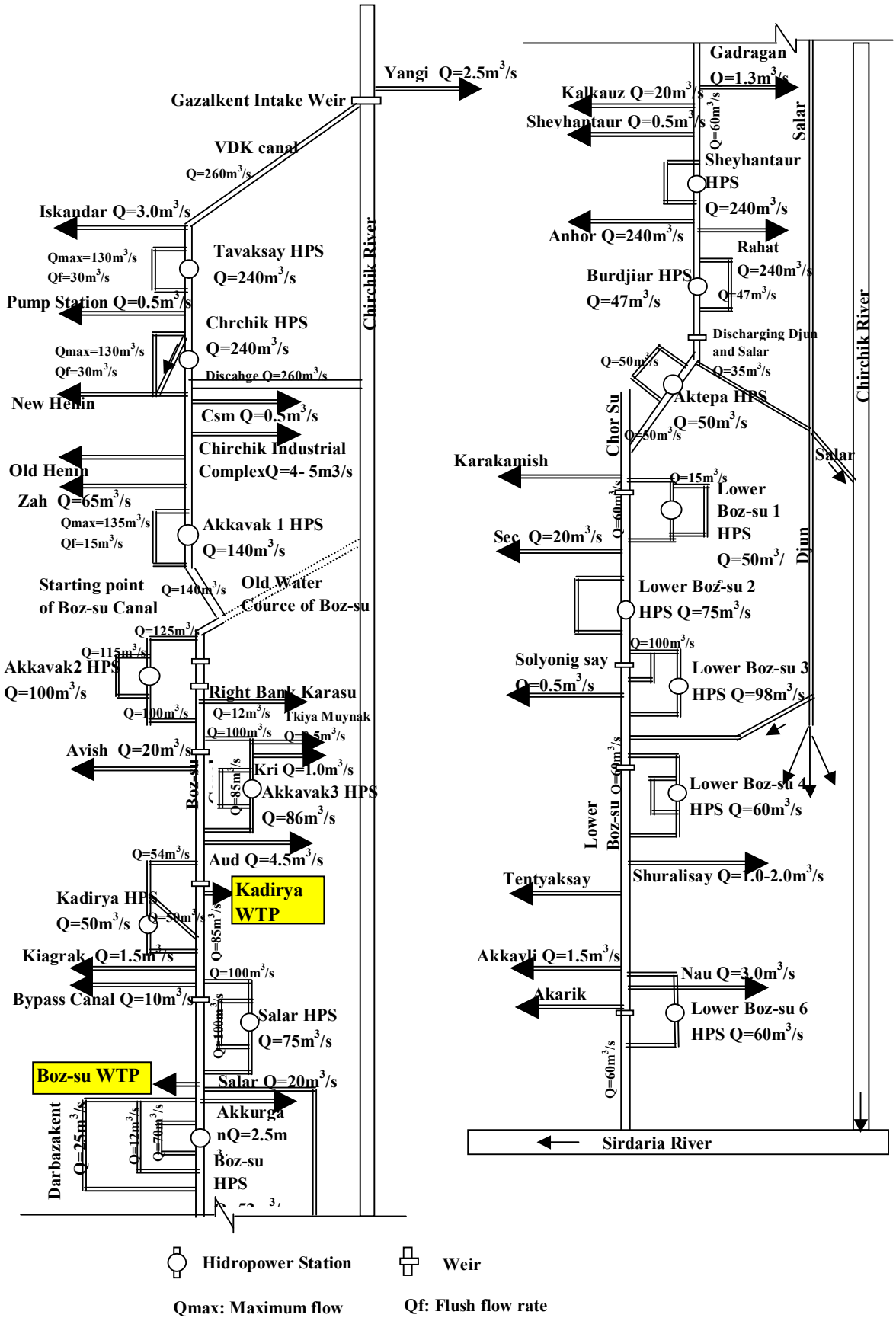

Figure 2.1.6 Canal Network in the Chirchik River Basin (Source: Vodokanal)

(3) Surface Water Source for Tashkent City

The existing WTPs (surface water and groundwater treatment plants) under the control of Tashkent Vodokanal are shown in Figure 2.1.7. The Boz-su canal is used to distribute water to WTPs.

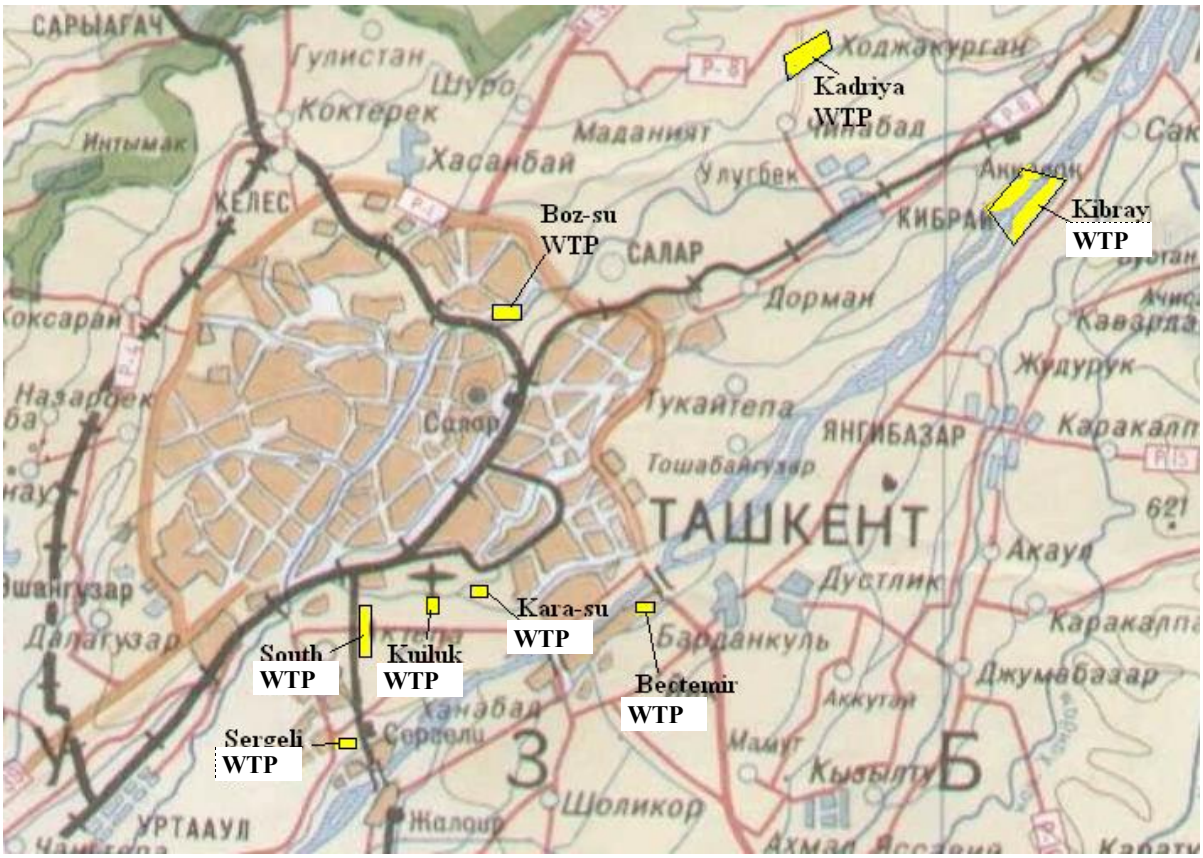

Figure 2.1.7 Location of WTPs of Tashkent Vodokanal

Table 2.1.4 Surface Water Intake Right of Tashkent Vodokanal

Intake Right	1000m^3/year	m^3/sec	1000m^3/day
Kadirya WTP	670,079	21.19	1,830.8
Boz-su WTP	98,029	3.1	267.8
Boz-su Canal total	768,108	26.59	2,297.4

Note: The figures in dark cells show in the regulation document for water source
(Source: Vodokanal)

Tashkent Vodokanal has water intake rights from the Boz-su Canal, as shown in Table 2.1.4. Since the nominal treatment capacities of Kadirya and Boz-su WTPs are 1,375,000 m^3/day and 235,500 m^3/day, respectively, the water intake right is sufficient for the present treatment capacities.

(4) Ground Water Source for Tashkent City

There are six water treatment plants drawing groundwater from wells, namely Kibray, South, Sergeli, Kuiluk, Kara-su and Bectemir WTPs as shown in Figure 2.1.7. All these plants are located in the neighborhood of the present or old Chirchik River.

The hydro-geological map of Tashkent City is shown in Figure 2.1.8(1) and its cross sections are shown in Figure 2.1.8(2), (3). Figure 2.1.8 (1) shows several active faults across the city. The geographical feature of Tashkent City is divided into four stages of terrace, covered with unconsolidated deposit. On the upland is the sand gravel layer of the Diluvium period of the Quarternary era, which shows thick accumulation. In the lowland along the Chirchik River, is the alluvium sand gravel layer which accumulated diluvial sand gravel layer with thicknesses that reach over 60 m. The permeability of these sand gravel layers is so high that they form efficient aquifers, the main intake layers of groundwater for Tashkent Vodokanal. However, limestone forms part this gravel layer, causing a high concentration of calcium, and a sodium bicarbonate ion, and a total hardness found in the extracted water.

The water intake rights of groundwater, based on investigation by and approval of the Geological Authority are shown in Table 2.1.5. The total amount of water intake right for Tashkent Vodokanal is as follow:

2,297,400 m^3/d (surface water)+1,260,300 m^3/d (ground water) = 3,559,700 m^3/day.

Table 2.1.5 Groundwater Intake Rights of Tashkent Vodokanal (1000m^3/day)

WTP	Area	Category				Total
		A	B	C1	C2	
Kibray	Right bank	157.7	35.2	41.5		234.4
	Left bank	354.6	193.0	153.6	56.2	757.4
	Sub total	512.3	228.2	195.1	56.2	991.8
South	I	39.9				39.9
	II	99.8	20.7			120.5
	Sub total	139.7	20.7			160.4
Sergeli		39.0				39.0
Kuiluk		29.8	39.3			69.1
Sub-total		720.8	288.2	195.1	56.2	1260.3

A: This quantity can be always withdrawn, B: This quantity can be temporarily withdrawn
C1: Potential of easy intake, C2: Potential of relatively difficult intake (Source: Vodokanal)

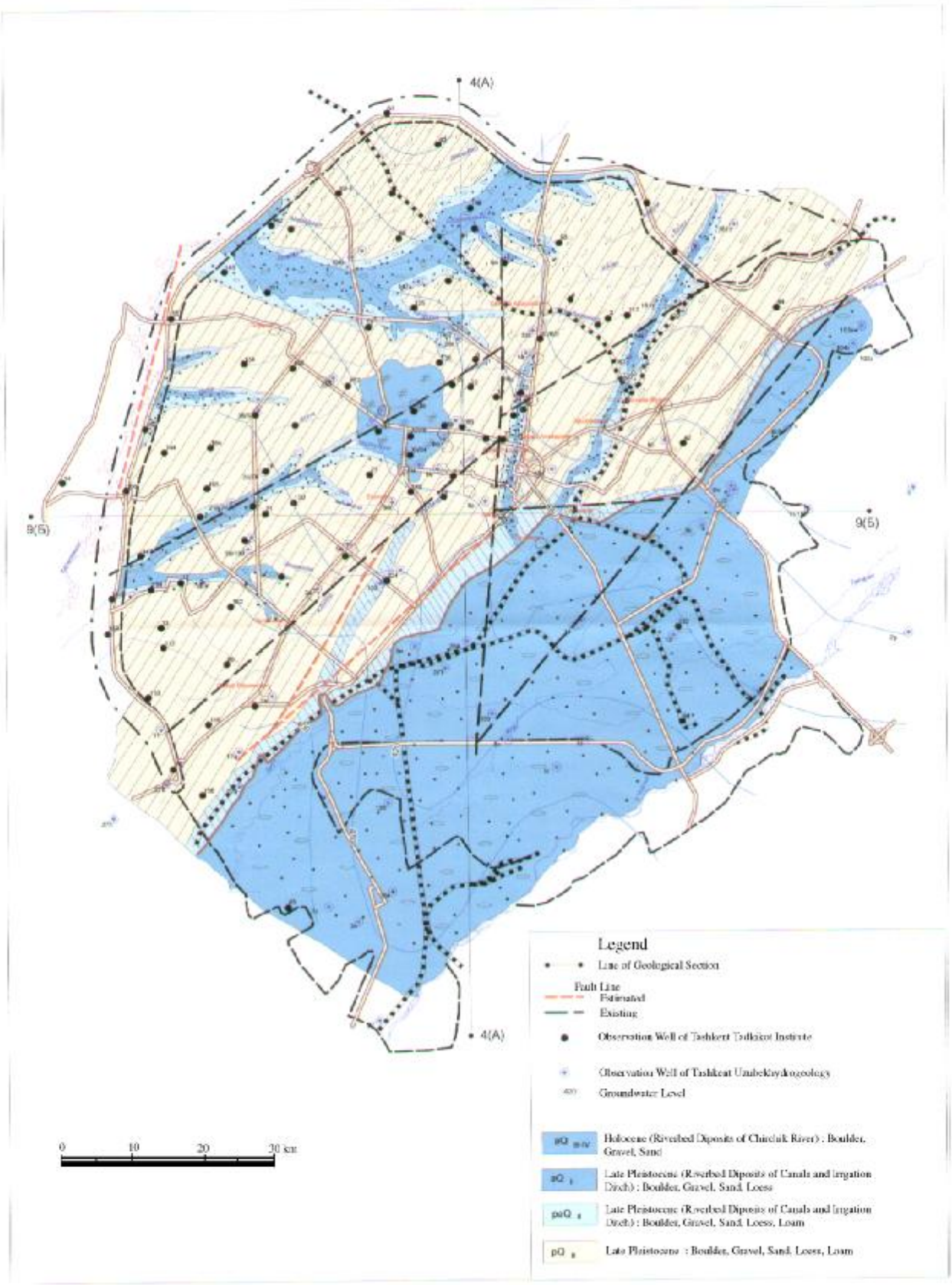

Figure 2.1.8(1) Hydrogeological Map of Tashkent City

(Source: Central Asia Hydrometeorological Institute)

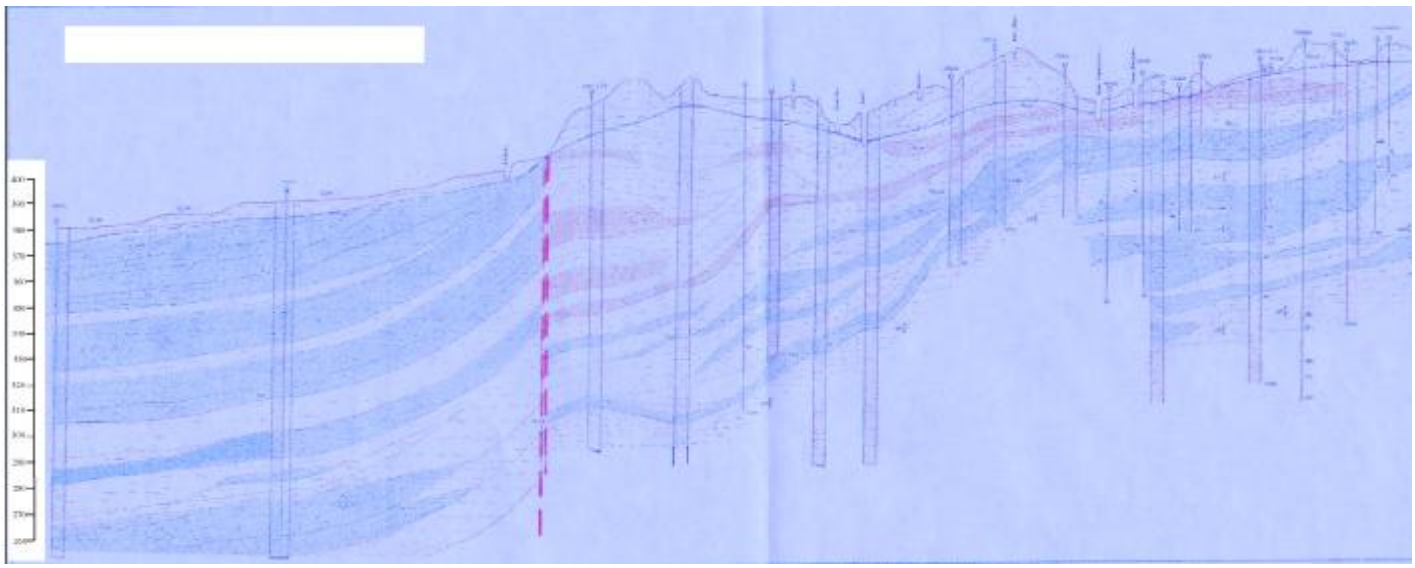

Figure 2.1.8 (2) Hydrogeological Cross Section (A-A')
(Source: Central Asia Hydrometeorological Institute)

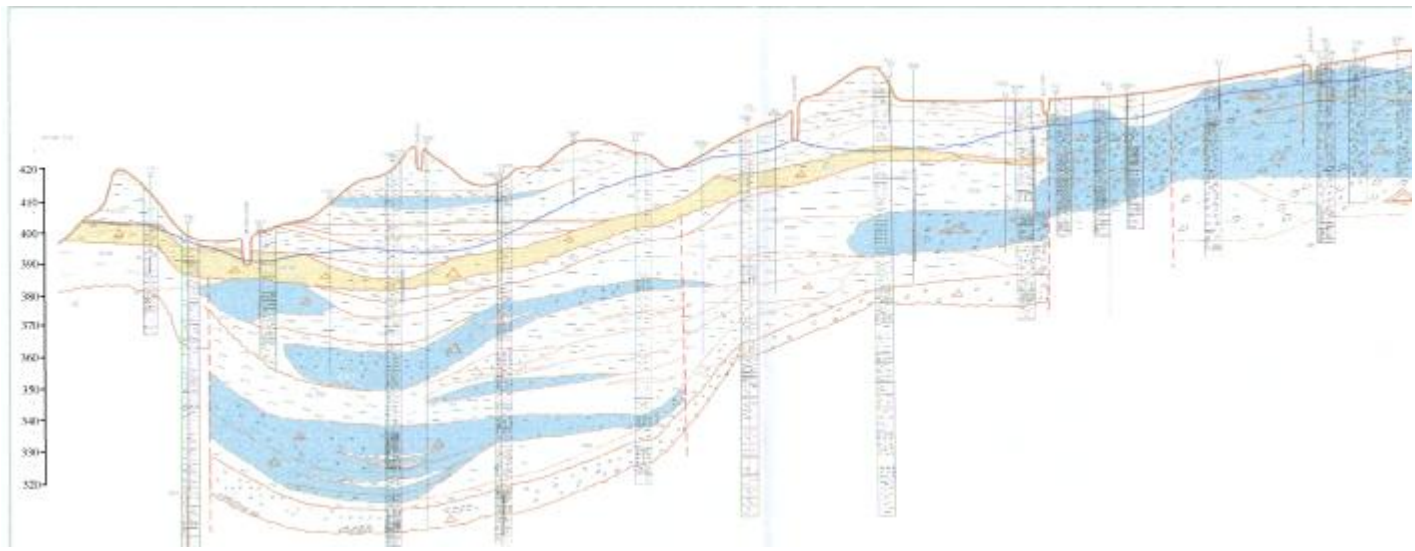

Figure 2.1.8 (3) Hydrogeological Cross Section (B-B')
(Source: Central Asia Hydrometeorological Institute)

2.2 Socioeconomic Conditions

2.2.1 Population

Table. 2.2.1 shows the current Tashkent City population and its forecast prepared by the Statistics Department of Tashkent City. According to official statistics, the population in Tashkent city as of 2002 was 2.14 million, which is equivalent to eight percent of the total population of the country. The population growth has been relatively stable over the last few years. According to the forecasts of the Statistics Department of Tashkent city, the population will remain constant until 2015.

Tashkent city is divided into 11 administrative districts, so-called "*Rayons*". Vodokanal provides services to the 11 districts of Tashkent city and the surrounding areas of the city, including Kibray, Kadirya and Ata. According to Vodokanal, their domestic consumers accounted for 98.5% of the total population of the city in 2002, plus 64,000 people in the surrounding areas.

Table 2.2.1 Population forecast of Tashkent City (thousands of people)

District	2003*	2004	2005	2010	2015
Akmal Ikramov	226.6	226.4	226.4	226.8	227.1
Bektemir	28.2	28.1	27.7	27.8	27.8
Mirabad	122.1	121.7	121.7	121.9	122.1
Mirzo Ulugbek	245.9	244.7	245.6	246	246.4
Sabir Rahimov	152.7	151.9	151.8	151.9	152.1
Sergeli	281.9	282.6	282	282.4	282.8
Hamza	207	206.3	207.2	207.5	207.8
Chilanzar	215.4	214.5	215.8	216.1	216.3
Shaihantohur	261.4	262.4	260.6	261	261.4
Unusabad	287.3	286.7	286.3	286.6	287.1
Yakkasaray	110.6	110.2	111.1	111.2	111.3
Total	**2,139.1**	**2,135.5**	**2,136.2**	**2,139.2**	**2,142.2**

*: year 2003 - 11 months
Note: Tashkent Vodokanal services cover not only Tashkent City but also Kibray, Ata and other vicinity towns with a total population of 63.8 thousand people.

2.2.2 Economy

(1) Macroeconomic Environment

Uzbekistan's economy at the time of its independence in 1991 had been heavily reliant on the production of cotton, gold, and natural gas. The standard of living was one of the lowest among all countries in the former Soviet Union. Under such circumstances, the government introduced an Import Substitution Industrialization (ISI) strategy, which was based upon exchange and trade control policies. This strategy envisions the transformation of the country's industrial structure, from an agriculture and natural resources-based economy to a modern industrial economy that emphasizes food and energy self-sufficiency.

However, this strategy resulted in the withdrawal of foreign capital from the country. Consequently, the Gross Domestic Product (GDP) growth rate of the country has remained at 4% for the past several years (in the manufacturing sector, it increased from 2.9% in 2001 to 3.4% in 2002[2]). The per capita GDP in Uzbekistan is less than 400USD[3], so Uzbekistan is categorized as a low-income country. According to the official statistics of the GOU, the yearly inflation rate was relatively high at 10.3%, which was measured by the consumer price index in 2003.

The official exchange rate of the local currency, soum, has experienced significant changes for the past years, from 110 at the end of 1998 to 970 soum for 1 USD at the end of 2002.[4] It should be mentioned though that the Government of Uzbekistan (GOU) announced currency convertibility starting from October 15, 2003 and lifted some of the restrictions on purchase of hard currency.

The details of the Republican Budget of the ROU are not publicly disclosed, as well as details of the City Budget of Tashkent. However, according to the World Bank, government revenues and expenditures of the ROU was estimated approximately at 2,000 million USD in 2002 and

[2] Source: *Uzbekistan at a Glance*, World Bank 2002 and 2003

[3] Source: *Uzbekistan at a Glance*, World Bank 2002 and 2003. Part of indicators is from reports by ADB

[4] Source: The Central Bank of Uzbekistan

the total external outstanding and disbursed debt of the ROU for 4,427 million USD in 2002 (4,670 million USD in 2001).[5] The annual refinancing rate set by the Central Bank of Uzbekistan from September 10, 2003 is 20%.[6]

The present macroeconomic policy of the country is in line with the agreements achieved between the GOU and the IMF, aimed at accelerating the transition to a market economy, achieving macroeconomic stability by reducing the role of the state in the economy and adopting tight fiscal and monetary policies.[7]

(2) Tashkent City

The food industry and machinery are two major sectors, which accounted for 29% and 24% of the City's industrial production respectively in 2002, according to official statistics. Production of consumer goods in Tashkent City grew by 20.2% in 2002.[8]

The average monthly salary in Tashkent City (total population of 2,134 thousand inhabitants as of October 1, 2003) was 44,187 soum in 2002, compared to 30,593 soum in 2001. Of the total household expenditures, on average 50.4% is spent on food, including alcohol & tobacco, 18.7% on services, including communal fees, 16.5% on other consumer goods, and the remaining 14.4% on non-consumer expenditures (taxes and duties, purchase of real estate, etc).[9]

(3) Communal Services Sector

The municipal (communal) service sector of Tashkent City includes such utilities as water supply and sewerage services, heating and hot water supply, gas and electricity supply, waste collection, etc.

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[5] Source: *Uzbekistan at a Glance*, World Bank

[6] Source: Central Bank of Uzbekistan

[7] The International Monetary Fund

[8] Source: Department of Statistics of Tashkent City

[9] Source: Department of Statistics of Tashkent City

Recent trends in tariffs for municipal services in Tashkent City are provided in the table below. The level of tariffs valid in January 2000 was taken as the base for comparison.

Table 2.2.2 Trends in Tariffs for Domestic Customers

	Water		Hot water		Gas		Electricity		Collection of garbage		Bus / Subway	
	Soum/ cu.m.	Change (times)	Soum/ capita	Change (times)	Soum/ capita	Change (times)	Soum/ kWh	Change (times)	Soum/ capita	Change (times)	Soum/ times	Change (times)
Jan.00	1.81	1.00	200	1.00	30	1.00	3.50	1.00	50	1.00	25	1.00
Jan.01	6.75	3.73	200	1.00	30	1.00	4.70	1.34	100	2.00	40	1.60
Jan.02	8.90	4.92	400	2.00	42	1.40	6.50	1.86	100	2.00	50	2.00
Jan.03	16.00	8.84	961	4.81	42	1.40	10.30	2.94	250	5.00	n/a	n/a
Oct.03	22.00	12.15	1100	5.50	105	3.50	15.50	4.43	250	5.00	150	6.00

Sources: TKEO, Vodokanal and Uzbekistan newspapers (Bus/Subway)

As shown in the above table, the growth of water tariffs in Tashkent City since January 2000 has been the most significant among all communal fees.

(4) Social Safety Net

The social safety net in the country includes different kinds of pensions and subsidies for such categories as pensioners, invalids, children in low-income families, unemployed, women on maternity leave, etc. The pension system is the largest in terms of expenditure and coverage of all social protection programs, which helps alleviate poverty amongst pensioners. It is important to note, that the earlier system of providing allowances for communal fees to a number of domestic customers determined by the state categories (such as veterans, invalids, etc.) at the expense of communal service enterprises, has been abolished starting from April 1, 2003.[10] Accordingly, Vodokanal is not obliged now to provide any allowances to its customers. Instead, the Government has started paying out monthly subsides from the budgetary funds directly to the entitled recipients.

[10] Edict of the President of the ROU "*On Introduction of Compensating Subsidies from April 1, 2003 Instead of Providing Allowances for Housing & Communal Fees*" dated March 27, 2003

There have been improvements in some indicators of well being in Uzbekistan as a result of the recent economic growth; but poverty remains a serious challenge for the country. Over a quarter of the population are still characterized as poor and one third as extremely poor.[11]

(5) Preliminary Affordability Assessment

According to the official statistical data for Tashkent City, the average number of people in a household is about 4, whereas the average household income, which includes total income of family members from employment, subsidies etc., is 81,803 soum.[12] Assuming the average accounted monthly water consumption to be approximately 39.9 m^3 per person, and the present tariffs are 22.0 and 10.5 soum/m^3 for water supply and for sewerage services respectively, water charges account for 1.1% of the average household income and water charges account with sewerage services for 1.6%. Based on a World Bank document, there is still some room to increase the tariffs if the tariff level of up to 3% of average income can be tolerated.[13]

Affordability of the present water charges for the lowest-income groups of customers has also been assessed. According to the current legislation, the minimum salary in Uzbekistan is set at the level of 5,440 soum and the minimum pension at 10,765 soum starting from May 1, 2003.[14] Thus, the present water & sewerage charges account for 4.2% of the minimum salary and 2.1% of the minimum pension, assuming the average water consumption to be the same as above. Therefore, the present water tariffs appear to be marginally affordable even for the poorest groups of customers; however, further social

[11] Source: *Uzbekistan Living Standards Assessment*, World Bank

[12] Source: Department of Statistics of Tashkent City

[13] Source: *Information and Modeling Issues in Designing Water and Sanitation Subsidy Scheme*. May 2000. The World Bank

[14] Edict of the President of the ROU "*On Increasing of Salaries, Pensions, Scholarships and Social Allowances from May 1, 2003*" dated April 2, 2003

safety net measures need to be developed in order to protect the most vulnerable groups in the population before any further increase of water tariffs takes place.

2.3 Water Supply Service

2.3.1 Outline of the Existing Service

The current situation of water supply services in Tashkent City is outlined as follows:

Table 2.3.1 Outline of water supply services and water supply facilities in Tashkent City (2002)

Item		Unit	Value	Remarks
Water Supply Area		km^2	340	
Served Population		1,000 people	2,107	
Coverage of Water Supply		%	98.5	
Number of Water Supply Connections		number	582,783	
Total length of Pipelines		km	3,494	
Daily Production Capacity		$1,000m^3/d$	2,296	
Annual Production		$1,000m^3$	754,300	
Daily Production *1	Max	$1,000m^3/d$	2,313	Estimated by the team (2003) : 3,100
		l/cap./d	1,098	Estimated by the team (2003) : 1,471
	Average	$1,000m^3/d$	2,067	Estimated by the team (2003) : 2,900
		l/cap./d	981	Estimated by the team (2003) : 1,376
Ratio of NRW *2		%	48.0	
Numbers of Staff of Vodokanal		People	5,014	
Water Pressure		m	From 10 to 25	
Water Sources		Boz-su canal and groundwater		
WTP		2 surface WTPs, 6 groundwater WTPs		

Sources : Vodokanal

*1 The figures in the "Value" column was reported to Tashkent city *Hokimiyat* by Vodokanal, whereas comments in the "Remarks" column were made by the Team based on the measurement during 2003.

*2 Non-Revenue Water (NRW) is the rate of the quantity of non-chargeable against water supplied.

2.3.2 Relevant Laws and Regulations

(1) Tashkent Vodokanal's Charter

The legal status of Tashkent Vodokanal, the water supply & sewerage enterprise in Tashkent City and its major rights and responsibilities are stipulated in the Charter of the company. Vodokanal is a state owned monopoly-enterprise, i.e. 100% owned and controlled by the Hokimiyat (Municipality) of Tashkent City. Starting from 2000, the official name of the company is GUPT "Suvsoz".

The main objective of Vodokanal according to the Charter is to supply water to domestic customers and industries, as well as to provide maintenance services. The main source of financing for Vodokanal is revenue from operations. Although Vodokanal is legally independent and supposedly a self-sufficient enterprise according to the Charter, the assets of Vodokanal are owned by the Hokimiyat and major decisions are heavily centralized, with the level of tariffs being the most important issue. Vodokanal may be liquidated or reorganized by the *Hokimiyat*.

(2) Basic Laws

Frequent amendments and updates of the legislations and regulations is a characteristic feature for the entire developing business environment in the country. The communal services sector is not an exception. Notwithstanding, several of the most fundamental legislative acts underlying the entire business of Vodokanal should be mentioned:

- *The Civil Code* of the ROU, effective from March 1, 1997 (with amendments) is the major civil law adopted in the country, which defines *inter alia* the legal status of Vodokanal;
- *The Tax Code* effective from January 1, 1998 (with amendments) determines the tax status of Vodokanal;
- Law No. 398 "*On Natural Monopolies"* dated April 24, 1997 (with amendments) defines restrictions imposed on Vodokanal as a natural monopoly enterprise, including tariff setting matters; and
- *The Labor Code* effective from April 1, 1996 (with amendments) regulates relations between Vodokanal and its employees.

Other legislative acts such as Laws, Decrees of the President of the ROU, Decisions of the COM and numerous by-laws regulate all aspects of Vodokanal's business.

(3) Communal Services Regulation

A number of legislative acts are devoted to reforming the communal sector. The most relevant are:

- Decree of the President of the ROU No. 2832 *"On a New Stage of Deepening Economic Reforms in the Communal Services Sector"* dated April 17, 2001 and the follow-up Decision of the COM No. 178 *"On Additional Measures for Improvement of the Communal Services for Domestic Customers"* dated April 18, 2001, which determined the role of the associations of tenants and institutions in the local governing of citizens for communal fee collections, set the maximum profit margin for communal enterprises at 10%, initiated establishment of private companies for repair & maintenance, amongst other measures;
- Decree of the President of the ROU No. 2791 *"On Further Reforming of the Management of the Communal Services System"* dated December 19, 2000 and the follow-up Decision of the COM No. 493 *"On Improving the Organization of Activity for the System of Communal Services"* dated December 21, 2000, which established the Agency "Uzcommunhizmat" to replace the Ministry of Communal Services, put TKEO under direct supervision of respective hokimiyats, as well as determined the role of these organizations. (Please refer to the "Organization" section for further details);
- Decision of the COM No. 74 "*On Approval of the Statute of Agency "Uzkommunhizmat", Pro-forma Statute of TKEO of the Council of Ministers of the Republic of Karakalpakstan, Hokimiyats of Oblasts and Tashkent City"* dated February 13, 2001 (with subsequent amendments);
- Decision of the COM No. 364 *"On Measures for Implementation of the Law of the ROU "On Natural Monopolies"* dated September 21, 2000, which detailed measures of the state control over the tariffs of natural monopolies;

- Statute *"On Cost Composition and Profit Margin Introduction for Setting Tariffs on Communal Services"*, approved by Decision No. 51 of the Ministry of Finance, the Ministry of Macroeconomics & Statistics and Uzbekistan Agency "Uzkommunhizmat" dated July 3, 2001, which determined the rules for setting tariffs;
- Decree of the President of the ROU No. 41 *"On Introduction of Compensating Subsidies from April 1, 2003 instead of Providing Allowances for Housing & Communal Fees"* dated March 27, 2003, which changed the system of providing allowances to certain categories of domestic customers; and
- Statute *"On Payments for Maintenance & Repair of Dwellings and Communal Fees in Cities and Inhabited Localities in the Republic of Uzbekistan"* approved by Order No. 68 of the Agency "Uzkommunhizmat" dated August 12, 2002 and registered by the Ministry of Justice of the ROU on September 13, 2002, which detailed procedures for payment of communal fees.

(4) Privatization Legislation

A significant legal base has been created to date in the ROU with regard to privatization. Since all issues relating to the on-going process of privatization of Vodokanal are discussed in details in the subsequent chapters of this report, this section is limited to enumerating the most relevant legislative acts:

- The Law *"On Denationalization and Privatization"* dated November 19, 1991 set out the legal basis for the transformation of state ownership. The Law set *inter alia* basic principals of denationalization and privatization such as combination of paid and free transfer of the state ownership, equality of all citizens in this process, provision of social protection, state and public control over the privatization, and compliance with the antimonopoly legislation. The Law also determined the objects excluded from privatization (such as water sources), defined the subjects entitled to participate in the privatization, forms and conditions for privatization, general procedures, etc.;
- Decision of the COM No. 97 *"On Additional Measures to Ensure Implementation of Denationalization and Privatization Programs, Attraction of Foreign Investors"* dated March 26, 2002 initiated privatization process for a number of communal service

enterprises in the country in 2002-2003 and included Vodokanal into the list of state enterprises to be privatized in the nearest future;

- Decree of the President of the ROU No. 3202 *"On Measures for Cardinal Increase of the Private Sector Share in the Economy of the Republic of Uzbekistan"* dated January 24, 2003 and the Decision of the COM *"On Program of Denationalization and Privatization of Enterprises for 2003-2004"* dated April 17, 2003 were issued for the purpose of further deepening of the privatization process, sharp reduction of the state share in authorized funds of enterprises, increasing the investment attractiveness of the objects, and foreign investors attraction; and
- Decision of the COM *"On Additional Measures to Accelerate Privatization of Low-Margin, Non-Profitable and Insolvent State Enterprises and Possessions"* dated August 26, 2003 detailed procedures, applicable for direct investments in low-margin, non-profitable and insolvent state enterprises being privatized. The procedures assume step-by-step decrease, down to zero, of the start-up price of these enterprises for those investors who suggest the best investment obligations aimed at their recovery.

(5) Water Law

The most fundamental law regulating relations in the area of water supply is Law No. 837 *"On Water and Water Use"* dated May 6, 1993 (with subsequent amendments). According to the Law, water resources are owned by the state. The Law is aimed at rational use of the water resources by industries and domestic customers, water protection from pollution and depletion, protection of the rights of water users, etc.

2.3.3 Organization

(1) Tashkent City *Hokimiyat*

The Municipality of Tashkent City (hereinafter referred to as "*Hokimiyat"*) is the top state executive power in the City. The City Mayor (*"Hokim"*) is appointed by the President of the ROU and approved by the Legislative Assembly *("Sovet Narodnyh Deputatov* ") of Tashkent City. The structure of the *Hokimiyat* includes the Staff of the Hokim, local hokimiyats in each of the City's 11 districts, and a number of subordinated departments and organizations.

The *Hokimiyat* of Tashkent City, being the founder of Tashkent Vodokanal and the owner of the assets of the water supply and sewerage systems, has the eventual responsibility for providing water supply services in the City. The First Deputy of the *Hokim* of Tashkent City supervises the work of Vodokanal and TKEO, amongst other organizations. Vodokanal is subordinated to *Hokimiyat* through TKEO.

Finally, according to Decision of the COM No. 364 dated September 21, 2000, tariffs of Vodokanal, as a natural monopoly enterprise, are required to be approved by the Finance Department of Tashkent City.

(2) TKEO

The Regional Communal Service Associations (hereinafter referred to as "TKEO") support activities of communal enterprises in all of the country's provinces and also in Tashkent City. TKEO were re-organized based on Edict of the President of the ROU No. 2791 dated December 19, 2000 and follow-up Decision of the COM No. 493 dated December 21, 2000. The Statute of TKEO was approved by Decision of the COM No. 74 dated February 13, 2001.

The Tashkent City TKEO, according to its Statute, is subordinated directly to Tashkent City *Hokimiyat*. It is responsible for providing all communal services such as water supply & sewerage, heating, etc. to domestic customers in the City, preparation of facilities for the winter season, capital repair of apartment buildings, establishment of TSZh and repair &

maintenance enterprises in the communal sector, construction of the communal facilities financed from the local budgets, etc. The TKEO is financed by those communal service enterprises and other organizations, which form this Association. Thus, Tashkent Vodokanal paid to Tashkent City TKEO 105.5 million soum in 2002. TKEO is a different organization from Tashkent City *Hokimiyat*; however, TKEO, whose current Director General is one of the Deputy *Hokims*, is virtually surbordinated to Tashkent City *Hokimiyat*.

(3) Agency "Uzkommunhizmat"

The most important Republican level institution in the field of water supply services is the Uzbekistan Communal Services Agency "Uzkommunhizmat". It was established based on Edict of the President of the ROU No. 2791 of December 19, 2000 and follow-up Decision of the COM No. 493 dated December 21, 2000. The Agency "Uzkommunhizmat" replaced the liquidated Ministry of Communal Services of the ROU. The Statute of the Agency was approved by Decision of the COM No. 74 dated February 13, 2001.

The Agency "Uzkommunhizmat" is subordinated directly to the COM and is responsible for reforming the entire country's communal services sector, the overall policies such as sector development and planning, coordination with other authorities, etc. Those decisions which are made by Uzkommunhizmat within its competence are obligatory for Vodokanal.

(4) TSZh

Activity of all TSZh, an abbreviation from *"Tovarischestvo Sobstvennikov Zhilja"* (Tenants Association), is based on Law of the ROU No. 761 "On Tenants Associations" dated April 15, 1999. According to the Law, TSZh are non-profit organizations of apartment owners living in the same apartment building, established for the purpose of management, maintenance and repair of the common property. With the establishment of TSZh, the then existing organizations of communal services for domestic customers (so called "ZhEK") were liquidated. As the result, TSZh took over many functions of the former ZhEK, such as repair & maintenance. Currently, the absolute majority of apartment buildings in Uzbekistan belong to one or another TSZh. The importance of TSZh for the

on-going reform of the communal services sector was re-confirmed by Edict of the President of the ROU No. 3038 dated February 26, 2002.

TSZh used to fulfill the role of Vodokanal's agents for collection of water fees; however, Vodokanal has stopped this practice since 2002. On the other hand, based on decisions inherited from the Soviet times, Vodokanal is forced to pay as much as 30% of the fees collected from domestic customers living in apartments to TSZh for the purpose of repair & maintenance of in-house pipes; a hardly justifiable amount.

(5) Mahalla Committees

Mahalla Committees are local governing institutions in Uzbekistan. Activity of these organizations is based on Law of the ROU No. 758 "On Institutions of Local Governing of Citizens" dated April 14, 1999. Mahalla Committees are supposed to fulfill an important role in practical realization of the social safety net measures, and to certain extent, in the collection of communal fees, primarily amongst domestic customers living in detached houses.

(6) Tashkent Vodokanal

1) Present Organizational Structure

The organizational structure of Tashkent Vodokanal consists of non-administrative field departments or sections such as water treatment plants, waste water treatment plants, departments of operation, sales, construction, purchasing, transportation, etc. and administrative departments or sections such as planning, accounting, human resources, inspection, legal, general, etc. The organization of Tashkent Vodokanal is similar to that of other water supply companies in CIS countries.

The General Director of Tashkent Vodokanal, who is appointed by Tashkent City Hokimiyat, changed only twice for the period since the year 1931, when Vodokanal was founded, to the year 2001, but has already changed five times since the year 2001.

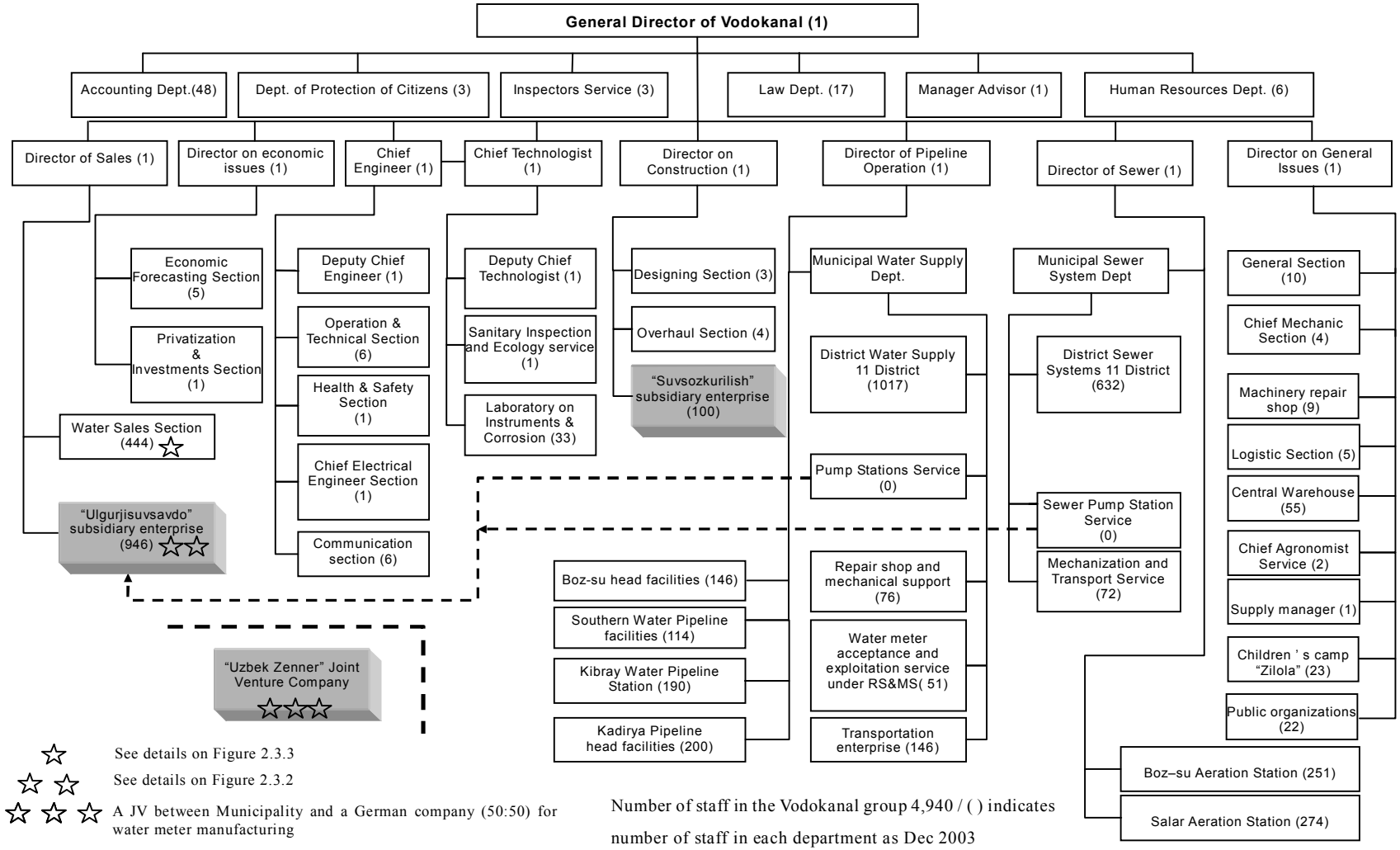


Figure 2.3.1 Organizational chart of Tashkent Vodokanal as of December 2003 Source: Vodokanal and survey

2) Number of Employees

The changes in the number of employees, as indicated in the table below, are based on a number of reasons. Firstly, the total number of employees increased by about 400 from 2002 to 2003. The major reason was a large number of newly employed inspectors in the Water Sales Section. Secondly, the total number of employees decreased by about 300 from 2003 to 2004. The major reason was the layoff in the departments or sections of administration, the Water Sales Section and the Municipal Sewer System Department, where a number of semi-skilled employees were fired.

Table 2.3.2 Number of Employees of Vodokanal

	As of 1.1.2002	As of 1.1.2003	As of 1.1.2004
Kadirya pipeline head facilities	187	186	184
Boz-su head facilities	148	147	145
Kibray Water Pipeline Station	202	206	196
Southern Water Pipeline facilities	106	111	114
Administration Departments and Sections	233	247	203
Water Sales Section	148	593	548
Municipal and District Water Supply Departments	2,132	2,059	1,115
Municipal Sewer System Department	888	944	639
Salar Aeration Station	276	265	265
Boz-su Aeration Station	259	256	240
Sub-total	4,579	5,014	3,649
Two Subsidiaries	0	0	1,046
Total	4,579	5,014	4,695

Source: Department of Planning of Vodokanal

3) Reorganization in Tashkent Vodokanal

During 2003, the following restructuring was executed in Vodokanal:

i) New sales subsidiary establishment;

ii) Reorganization of Vodokanal sales section;

iii) New construction subsidiary establishment; and

iv) Water meter manufacturing joint venture establishment.

In addition to the above, Vodokanal terminated over 300 employees. As a result of the restructuring, the number of Vodokanal employees at the end of November 2003 was reduced to approximately 3,600.

i) New sales subsidiary establishment - Ulgurgisuvsavdo

In July 2003, a former Vodokanal sales group, which dealt mainly with industry clients was separated from Vodokanal and a new subsidiary, Ulgurgisuvsavdo, was established. This company is owned 100% by Vodokanal and is not a stock company. The main objective of this company is to sell water to industry clients that usually pay their bills on time, as well as operation and maintenance of No.3 Pump Stations and renewal or improvement of the pumps in these Stations using internally generated funds. However, the ownership of No.3 Pump Stations still remains in Vodokanal and all operation and maintenance costs, except for the salaries, are borne by Vodokanal. Ulgurgisuvsavdo purchases water from Vodokanal at 22 soum/m^3 and sells it to clients at 39.66 soum/m^3. Some clients, whose payments are in arrears, were left in Vodokanal during the course of the restructuring process. As described above, this company is designed and established to earn funds for pump renewal or improvement, and so far, the results of its operation and water bill collection status are quite well. The number of employees is approximately 1,030.

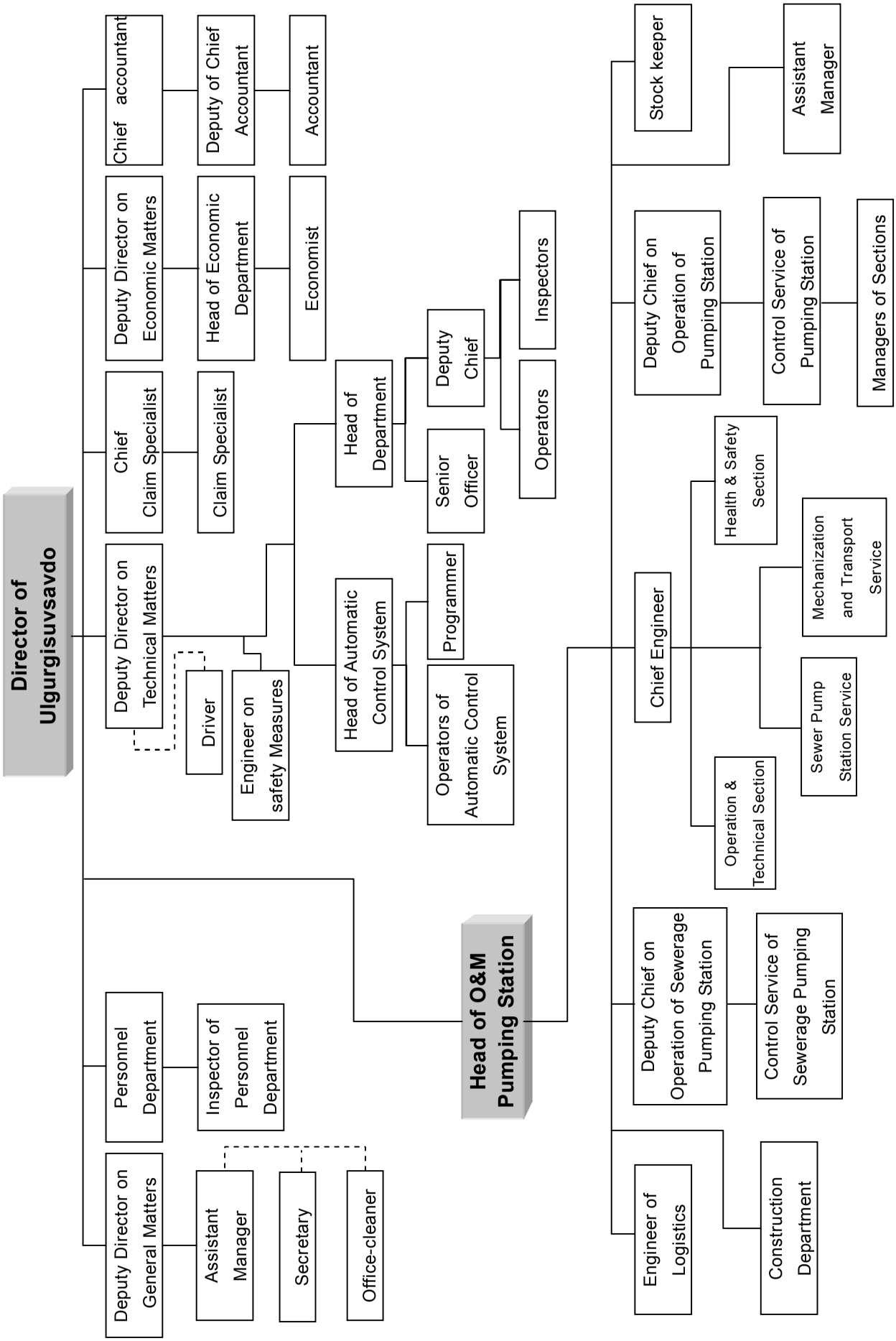


Figure 2.3.2 Organizational chart of Ulgurgisuvsavdo

ii) Reorganization of the Sales Section of Tashkent Vodokanal

Vodokanal Communal Service Group, which was referred to as "Budgetary Organizations Group" in the previous JICA Report, was reorganized along with the separation of the Industry Group. Some clients of the Industry Group were transferred to the Communal Service Group as described above. Thus, 10-15 clients were transferred, including an aircraft manufacturing company, TAPOiCh, the second or third debtor during these years. The biggest debtor, Tashteplocentral, heating and hot water supply company, was originally under the Communal Service Group. As a result, almost all big debtors have become the clients of the Communal Service Group. The Detached Houses Group and the Apartments Group have not been affected by this reorganization.

As a result of the reorganization mentioned above, the present Sales Section organization chart in Tashkent Vodokanal is shown in Figure 2.3.3: Rayon Vodokanal is a district water supply office.

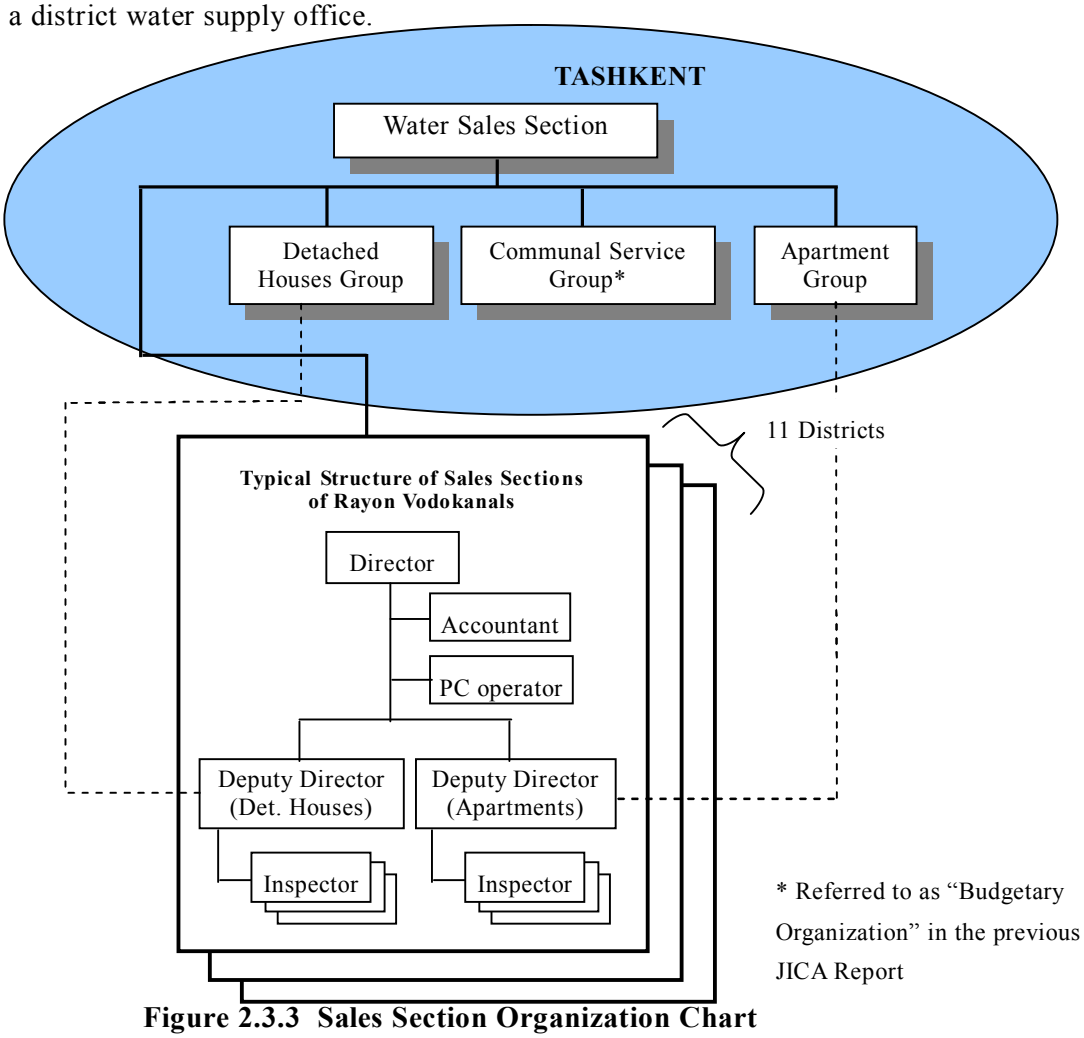


Figure 2.3.3 Sales Section Organization Chart

iii) New construction subsidiary establishment - Suvsozkurilish

In June 2003, Tashkent Vodokanal liquidated at that time existed construction organization and by utilizing a part of the resources of that organization, established a new subsidiary, Suvsozkurilish. The number of its employees is 56. This company is also owned 100% by Vodokanal and is not a stock company. The business of this company has not been changed much and the main activity is renewal or construction of piping networks in certain areas in Tashkent City. This company receives orders from Vodokanal only. The fixed assets of this company, including construction equipment, office buildings, vehicles and etc. were transferred from Vodokanal. The company's first quarter (July to September) net result is just 9,000 soum and according to the chief accountant, the reason of the low net income was the initial cost for the company setup.

iv) A water meter manufacturing joint venture establishment - Uzbek-Zenner

In 2003, a joint venture Uzbek-Zenner was established with investment by Tashkent City Hokimiyat and Zenner, a German instrument manufacturer. This company manufactures water meters for Vodokanal. In March 2003, this company became the sole meter supplier to Vodokanal.

Tashkent Vodokanal is in the process of reorganization. Thus, in 2004, additional changes will be considered by the management.

2.3.4 Water Consumption (Details are referred to S 2.3.4)

(1) Water Consumption Trend Based on Tariff Collection Data

Population data obtained from the Statistics Department of the City and Vodokanal specifying the number of registered/contracted customers are shown in Table 2.3.3(1). The data from the City shows that 98.5% of the population is served with piped water supply by Vodokanal, but the data from Vodokanal itself shows that the served population is less than 30%.

There is an explanation to the disparity in the data supplied by the City and Vodokanal. A significant number of people with registered water supply contract are no longer living in the City, while some people residing at company apartments may not be registered or do not have water supply contracts. Some also may intentionally not register. After a thorough review, the Team ascertained that the actual number of residents is about 22% more than that declared number in the Pilot Study. Thus, the under-declaration of registered residents could account for major difference in the official records of the City and that of Vodokanal; with the data given by the City as more reliable estimate.

There is a difference in the water consumption characteristics of residents living in apartments and independent houses. However, the data supplied by the City does not differentiate between these two types of consumers or customers. As such, what is being utilized in this study will be the number of contracts that Vodokanal has for each District and apply this to the population provided by the City. In addition, the number of contracts that Vodokanal has in the areas surrounding the City shall be made part of the total service population, as shown in Table 2.3.3 (1).

Table 2.3.3 (1) Service Population of Tashkent Vodokanal

Category		Data			Decided service population		
		City area		Surrounding area			
		City Statistic Department	Vodokanal contract		City area	Surrounding area	Total
Registered number (x1000)		2139.8*	----	----	2,139.8	----	----
Service ratio (%)		98.5	----	----	98.5	----	----
Service population (x1000)	Total	2,107.0	1,613.6	77.8	2,107.0	77.8	2,184.8
	Apartment	1,376.8	1,062.5	14.0	1,376.8	14.0	1,390.8
	Detached house	730.2	551.1	63.8	730.2	63.8	794.0

*: Data directly obtained from Statistic Department of the City

Table 2.3.3 (2) shows water consumption derived from water charges of Vodokanal, where per capita consumption is calculated. The per capita consumption for large consumers is calculated by dividing it by the total service population as shown in the table. The consumption of budgetary organizations (public organizations) includes the supply of water to Tashkent Region Vodokanal, of about 72,000 m^3/d. Hot water is distributed to domestic customers and large consumers from the hot water plants, 11 of which are located in many part of the District. According to Tashteplocentral (Tashkent Hot Water Supply Works), 76% of hot water was used by domestic customers.

Table 2.3.3 (2) Water Consumption based on Water Charge in Tashkent City (2002)

Items			Population (x1000)	Consumption	
				1000m^3/d	Lpcd
Domestic Customers	1) Apartment		1,390.80	461	331
	2) Detached		780.00	143	183
	3) Sub-total		2,170.80	604	278
Large Consumers	4) Budgetary*			290	134
	Hot Water	5) Domestic		347	160
		6) Large		148	68
		7) Sub-total (5+6)		495	228
	8) Small Industries			111	51
	9) Sub-total (4+7+8)			896	413
10) Domestic Customers (3+5)				951	438
11) Large Consumers (4+6+8)				549	253
Total consumption (10+11)				1,500	691

*Including supply to Tashkent Region Vodokanal:72,000m^3/d

Figure 2.3.4 shows the monthly water consumption trends in the City. The average values of each category are shown in Table 2.3.3 (2). The fluctuation of total consumption is relatively small, however the consumption by hot water plants apparently increases in winter. Both the TKEO and Vodokanal have determined that the main reason of the water loss is water loss from heating equipment of consumers, and therefore TKEO is planning to improve the heating system.

The meter installation ratio is quite low in the City as shown in Table 2.3.4. The tariff charge for domestic water consumption is calculated mainly by utilizing a per capita Norm.

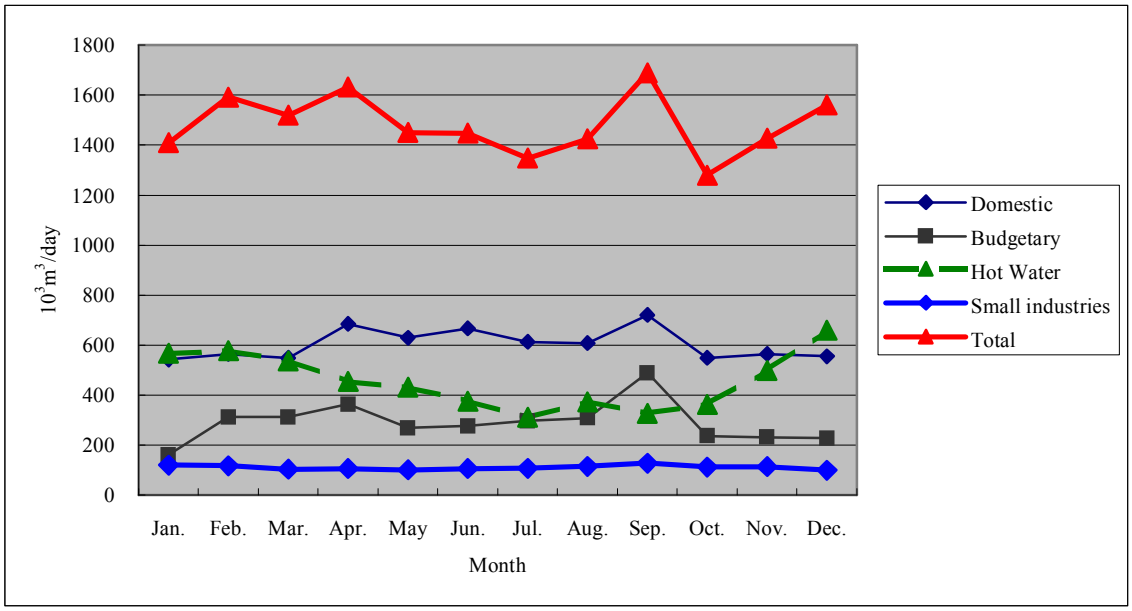


Figure 2.3.4 Trend of Monthly Water Consumption in the City in 2002

The installation ratio of water meters for domestic customers is much lower than that for large consumers as shown in Table 2.3.4.

Table 2.3.4 Meter Installation Ratio by Consumer Category (in 2002)

Division	Domestic Customers		Large Consumers		
	Apartment	Detached	Budgetary	Hot water plants	Others
Installation ratio (%)	9.2	33.2	78.7	100.0	84.6

(Source: Vodokanal)

Figure 2.3.5 shows the water consumption of each consumer category from 1998 to 2002. The total consumption decreased by 23 % in the past four years.

(2) Domestic Water Consumption

Figure 2.3.6 shows the monthly domestic water consumption in 2002, which was calculated based on the collection records of customers living in apartments and detached houses. The water consumption for detached houses shows a high increase in the summer season, because of the need to water gardens within their premises. Table 2.3.5 shows the results of the water consumption survey conducted by Vodokanal. Table 2.3.6 shows a part of the survey results conducted by the JICA Study Team in 1999.

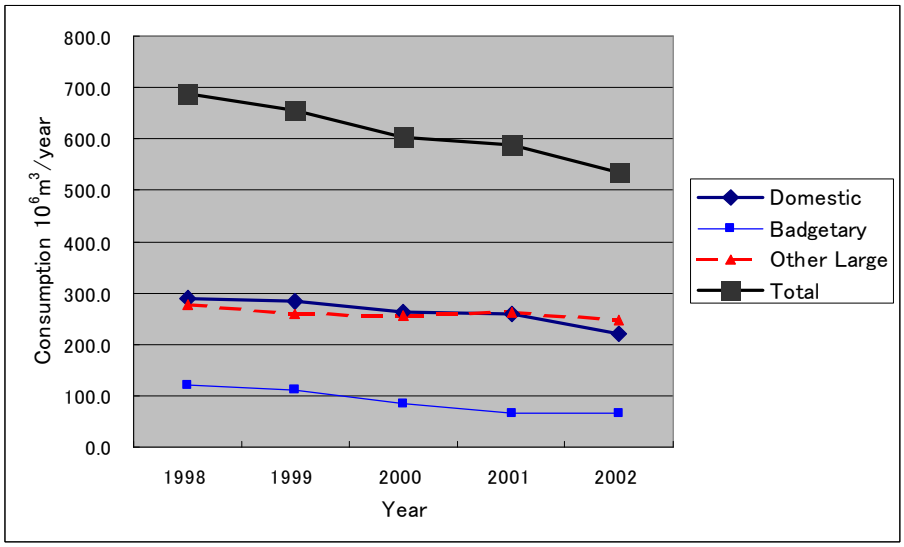


Figure 2.3.5 Trend of Annual Water Consumption

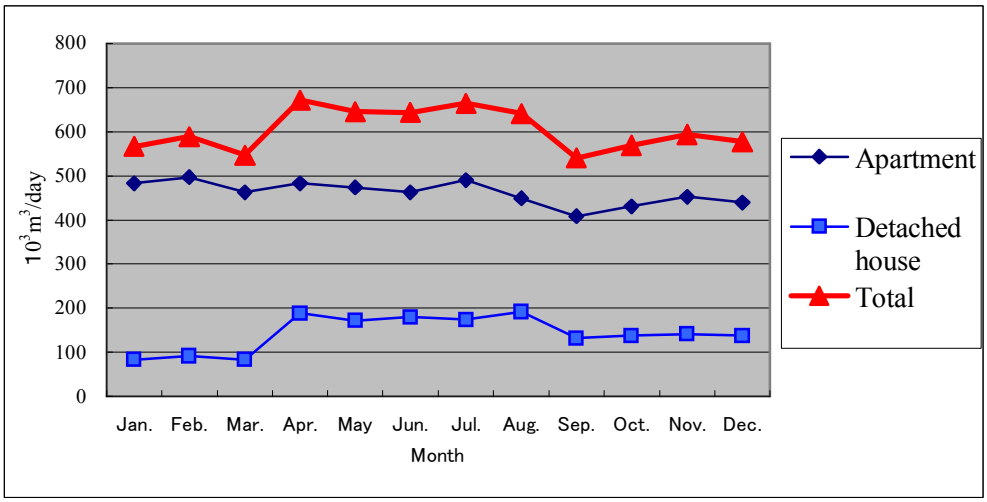


Figure 2.3.6 Monthly Domestic Water Consumption in the City (2002)

In addition, the Team analyzed meter-reading records of three to five districts in 2003 for three categories of domestic customers: apartments, detached houses with sewer connection, and detached houses without sewer connection, as shown in Figure 2.3.7. Seasonal changes in water consumption were clearly observed for customers in detached houses in contrast to those in apartments.

Table 2.3.5 Water Consumption Survey Results

Category		Result of Vodokanal survey		
		Measured	Norm	Sample population
		Lpcd	Lpcd	
Apartment	With meter	161	----	62,162
	Without Meter	583	330	21,056
Detached house	With meter	203	----	63,937

Note: Measurement duration January to March in 2001

(Source: Vodokanal)

Table 2.3.6 Water Consumption of Detached Houses without Meter

Month	August	September	November	Estimated annual average
Consumption (Lpcd)	460	601	180	300

(Source: JICA Study Report in 2000)

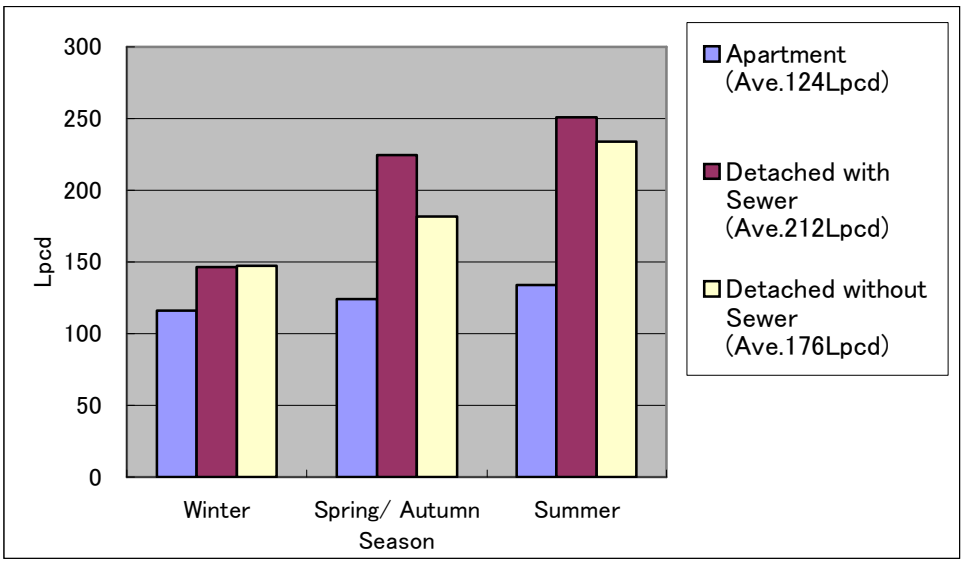


Figure 2.3.7 Consumption of Domestic Customers

The difference in water consumptions between consumers with and without water meters was very significant. The main causes were the leaks from water service equipment such as toilets, faucets, showers and pipe connections and from wasteful use. The water consumption of apartment without meters is even higher than the Norm. It means that much NRW is generated from this category because Vodokanal collects the water charge calculated by the Norm.

Water consumption of category (1) was calculated at 161 Lpcd, as shown in Table 2.3.5. However, the results of other surveys gave values less than 150 Lpcd. Therefore, the value of category (1) is set at 150Lpcd. The values of category (2) and (3) are set at 580 and 200 Lpcd, respectively, based on the survey result of Vodokanal as shown in Table 2.3.5. The value of category (4) is set at 300 Lpcd based on Table 2.3.6, and because the difference between the measured value and the Norm is sizeable, as shown in Table 2.3.5, this category also generates large NRW.

(3) Adjustment of Per Capita Consumption of Domestic Customers

Adjustments had to be made to the per capita consumption of domestic customers to reflect the changes made with regard to the population figure adopted for use in this study. Initially, the surveys on per capita consumption of domestic users utilized the population data from Vodokanal. In the course of the study, however, it was found out that the population registered by Vodokanal is less than the population projected by the Tashkent City Statistics Department, and that the data of the Statistics Department was more accurate. Therefore, the survey results should be modified using the population projected by the Statistics Department. Recently, the management of Vodokanal discovered that their meter reading records were dubious since many of their collectors were collecting water charges without properly reading the water meters. In many cases, the collectors relied on the values declared by the consumers, which were much lower than the actual consumption. However, the per capita consumption of customers with meters was not modified to provide for the underestimation. Only the consumption for those without meters was adjusted, as shown in Table 2.3.7.

Table 2.3.7 Modification for Per Capita Consumption

Division		Population (x1000)		Per capita consumption (Lpcd)			
		Statistic*1	Vodokanal *2	Surveyed value	Calculated value*3	Average value*4	Modified alue*5
Apartment	Total population	1,391	1,076.5				
	With meter	130	99.0	160	123	142	150
	Without meter	1,261	977.5	580	449	514	500
Detached house	Total population	780	600.9				
	With meter	259	192.3	200	154	177	200
	Without meter	521	408.6	300	231	265	270
Repaired apartment with bulk meter				300	232	266	260

*1: Population projected by Statistic Department
*2: Population registered by Vodokanal
*3: surveyed value x Vodo. pop./Statistic pop.
*4: Average of surveyed and calculated value
*5: Modified value for water demand projection

(4) Water Consumption for Large Consumers

As shown in Table 2.3.4, over 80% of the large consumers have been installed with water meters, thus, the water consumption shown in Table 2.3.3(1), (2) does represent the actual consumption, even if it includes loss attributed to wasteful use and to leaks.

The Study Team observed that in public office buildings, restaurants, shops and markets, the majority of toilets had leaks, implying that the amount of water lost to leakage by large consumers may be quite high. The per capita consumption for large consumers, except for hot water supply for domestic customers and Tashkent Region Vodokanal, is 220 Lpcd based on the population projection made by the Statistic Department, which is shown in Table 2.3.3(2).

(5) Estimation of Actual Water Consumption in the City

In Sub-section (1), water consumption was calculated based on the water charges' records. However, it has been established that non-metered (or Norm-based) consumption does not represent the actual consumption, and that the difference between the Norm and actual consumption is higher for apartment residents than those living in detached houses as shown in Table 2.3.5. The table reveals that not only there are more customers living in apartments, but that the meter installation rate for apartments is also lower than for detached houses.

There is a need, therefore, to recalculate the actual water consumption in the City based on the actual per capita consumption. The modified per capita consumptions in Table 2.3.7 were used to calculate of the actual water consumption as shown in Table 2.3.8. The average distribution amount and the consumption value for large consumers were obtained from Vodokanal. The difference between the calculated results and the amount of annual average distribution, which is the system distribution loss coming from pipe leakages and unauthorized tapping into distribution pipes, is only 15.9 %. Meanwhile, the hourly water distribution pattern is almost flat. This indicates the existence of a huge amount of water leakage casting doubts on the average distribution amount, which calls for further investigation for clarification.

Table 2.3.8 Calculation of Actual Consumption

Category			Ratio %	Population*1 x1000	Consumption Lpcd	Consumption (1000m^3/d)	
						Actual	Water charge based*2
Domestic	Apartment	With Meter	9.2	128	150	19	461
		Without M.	90.8	1,263	500	631	
	Detached house	With Meter	33.2	259	200	52	143
		Without M.	66.8	521	270	141	
	1) Sub-total			2,171	388	843	604
Large	2) Budgetary				138	290	290
	Hot water	3) Domestic			160	347	347
		4) Large			68	148	148
		5) Sub-total (3+4)			228	495	495
	6) Small Industries				53	111	111
	7) Sub-total (2+5+6)				419	896	896
8) Domestic Customers (1+3)					552	1,190	951
9) Large Consumers (2+4+6)					253	549	549
10) Total consumption (8+9)					805	1,739	1,500
Ave. distribution amount (m^3/d) *2						2,067	2,067
Difference		1000m^3/d				328	567
		Ratio (%)				15.9	27.4

Source:*1 Tashkent City Statistics Department

*2 Tashkent Vodokanal

2.3.5 Water System and Facilities

(1) Water Treatment Plants (Details are referred to S 2.3.5)

1) Surface Water Treatment Plant

There are two surface water treatment plants (WTPs) in Tashkent City, namely Kadirya and Boz-su WTP. The details for both WTPs are shown in Table 2.3.9. The process flow and layout plan of each WTP are shown in Figure 2.3.8(1),(2) and Figure 2.3.9 (1),(2), respectively.

Table 2.3.9 Specifications of Surface Water Treatment Plants

Items		Kadirya WTP	Boz-su WTP
Design capacity (1000m^3/d)		1,375	235.6
Actual production Q (1000m^3/d)		1,800-2,200	227-290 (Ave.234)
Water intake right Q (1000m^3/d)		1,830.8	267.8
Site area (ha)		138	72
Construction (Expansion) year		1969('72, '75, '78, '81)	1931('36, '56, '61, '73, '77)
Treatment process		Intake Weir +coagulant sedimentation +intake Pump+ rapid filter + distribution reservoir	
Sedimentation	Basin	V=500,000+1,000,000=1,500,000m^3 , A=120,000+112,500=233,500m^2, Retention time: 1.1day	V=37,100+52,900=90,000m^3, A=14,000+14,720=28,720m^2 Retention time: 8.2hr
	Sludge discharge	Withdrawal by dredger boat, and Sludge is thrown into Boz-su canal	
		400m^3/hr+800m^3/hr	400m^3/hr
	Dosing	Chemical: $Al_2(SO_4)_3$, Injection by gravity after dissolving	
Intake PS		(12,500m^3/hr x 11 +6,300m^3/hr x 4) x head 26m	(4,700m^3/hr+3,000m^3/hr+6,300m^3/hr x2) x head 26m
Rapid filter	Filter	Old filter: 108.8x12+118x12 =2,722m^2 New Filter:166x 24=3,884 m^2, Total 6,604m^2, double layer type, and filtration rate 208m/d=8,7m/hr	60.9x6=364m^2 rectangular basins+ 52.8x 12=634m^2 circle basins, double layer type, and filtration speed 236m/d=9.8m/hr
	Washing	Backwashing by pumps, speed 0.6-0.7m/min, manual operation for washing	
Distribution reservoir		10,000m^3x 3	10,000m^3x2+6,600m^3x1+3,300m^3x1
Disinfection		Chemical: liquid chlorine by 1 ton cylinder, evaporator + measuring by flow-meter + vacuuming +melting in pressure water+ injection by pressure water	
Distribution	Method	Most of the water is distributed by gravity, but a small highly elevated distributes water utilizing a pump 2,700m^3/hr x 58mH x 2	By pumps capacity: 3,200m^3/hr x 2 x 55mH+2,800m^3/hr x 65mH x1+ 6,300m3/hr x 25mH x 1
	Area	Most of the city area	East area from the WTP
Laboratory		Operating	Operating

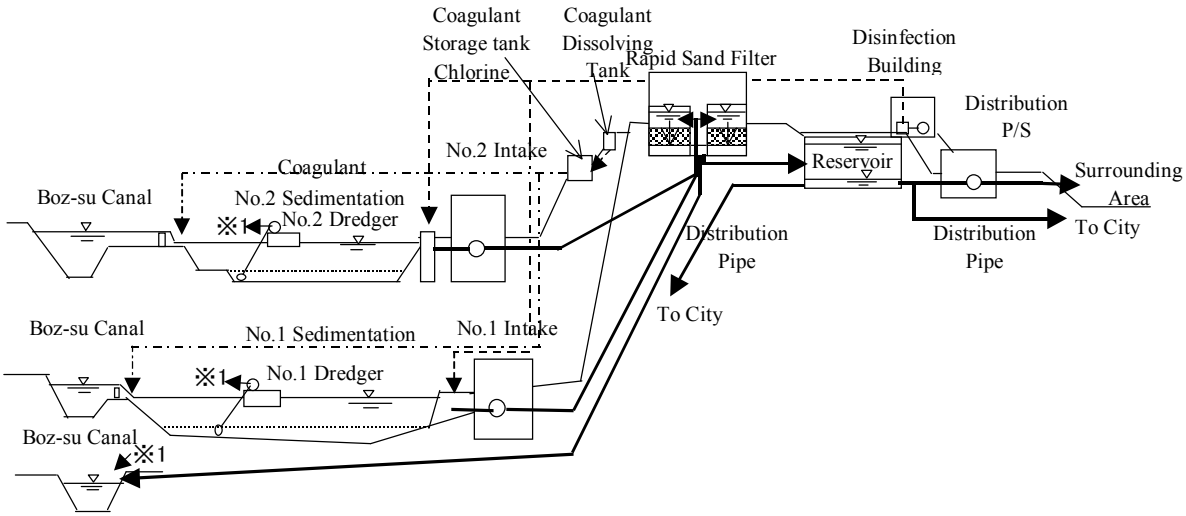


Figure 2.3.8 (1) Flow Sheet of Kadirya WTP

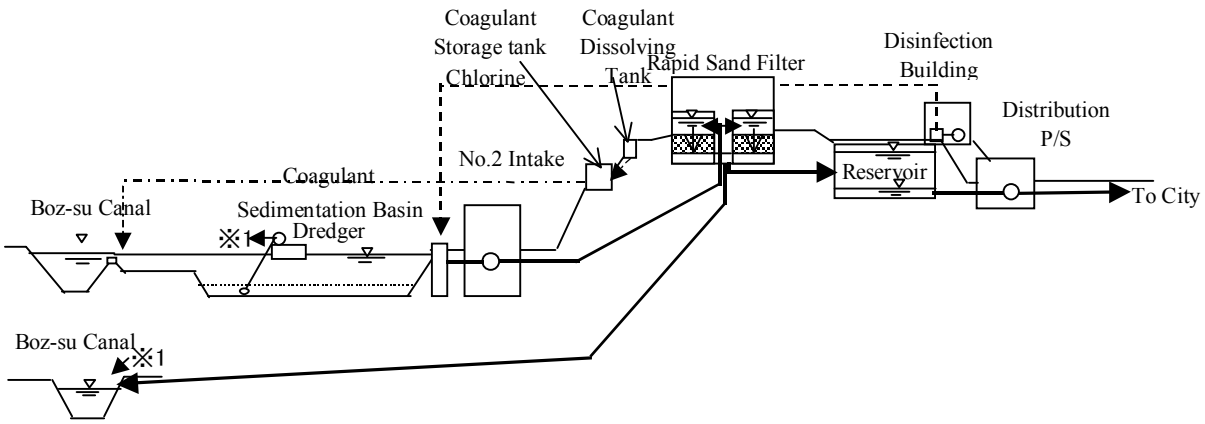


Figure 2.3.8 (2) Flow Sheet of Boz-su WTP

i) Kadirya WTP

Kadirya WTP is the latest among the WTPs in the city, having been augmented until the 1980s. In the use of surface water from the Boz-su Canal, raw water is treated by a combination of chemical sedimentation and rapid sand filtration processes as shown in Figure 2.3.8 (1). The condition of these facilities is superior to any other WTPs in the city, having the lowest operation cost per cubic meter among the WTPs of Vodokanal, providing gravity flow to the service area (except for the surrounding areas with higher elevations). However, some facilities, such as the intake pump stations (PSs), require urgent rehabilitation.

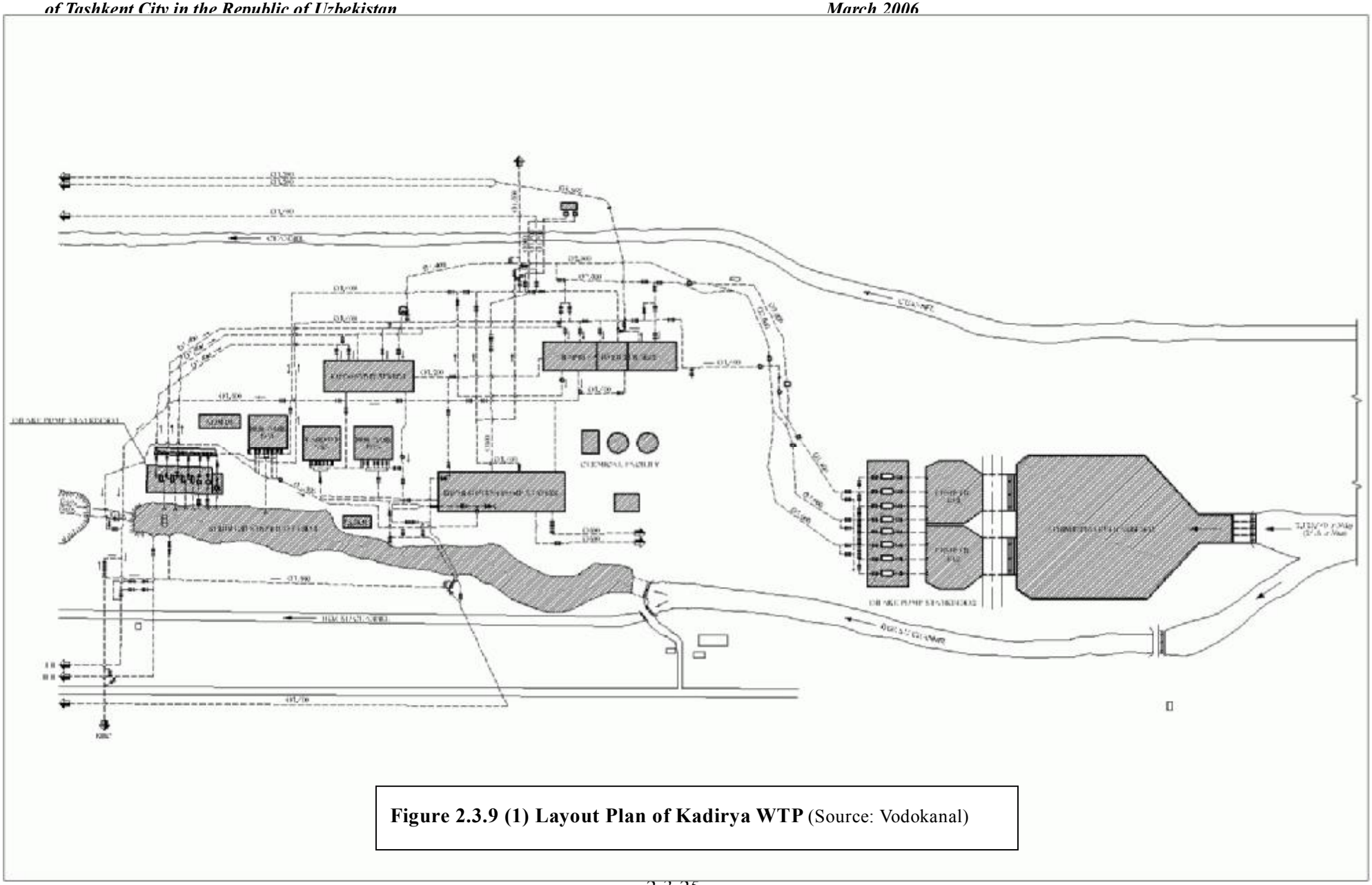


Figure 2.3.9 (1) Layout Plan of Kadirya WTP (Source: Vodokanal)

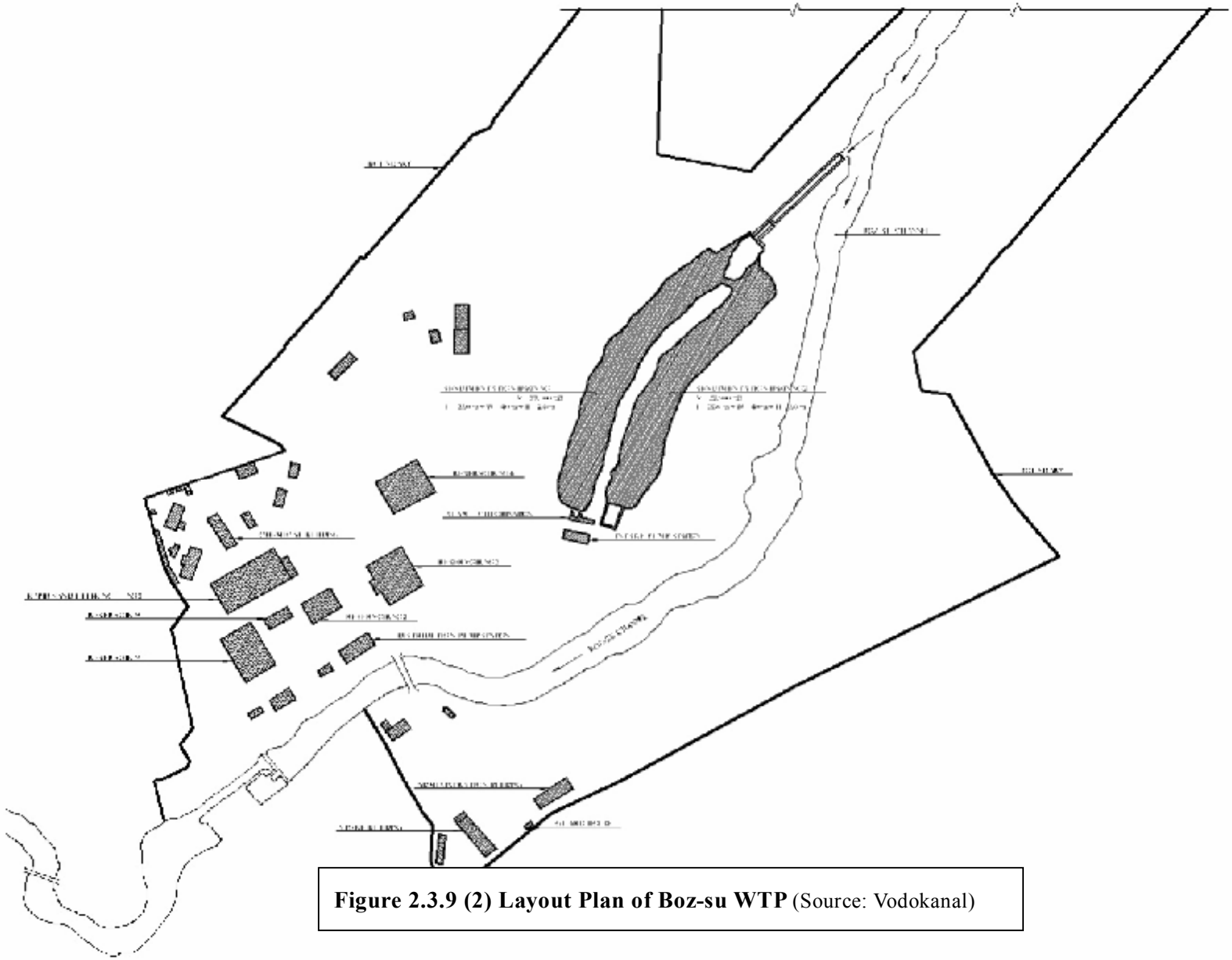


Figure 2.3.9 (2) Layout Plan of Boz-su WTP (Source: Vodokanal)

The amount of current water production at the Kadirya WTP (2,250,000-1,800,000 m^3/d) exceeds the design capacity of 1,375,000 m^3/d. Under this condition, the two intake PSs are currently being operated simultaneously, although one of them was designed as a stand-by station. Furthermore, the actual filtration rate exceeds the SNIP standard (which is the design standard of former Soviet Union, and is still used as the national standard for former member states). The filtration speed is designed to be 8.7 m/hr (the standard for water supply facilities is regulated as 'SNIP 2.04.02-84' and the filtration rate for double layer is regulated to be 12 m/hr), but the actual rate is reported at 14m/hr. Accordingly both the intake and filtration processes are obliged to operate under overloading conditions. The sedimentation basin is large enough to accommodate sediment.

ii) Boz-su WTP

Boz-su WTP, which is the oldest WTP in Vodokanal and located downstream of Kadirya WTP in Tashkent city, utilizes raw water from the Boz-su Canal. The treatment process is the same as in Kadriya WTP as shown in Figure 2.3.8 (2). Some of original structures, such as the civil structures of the rapid filters, are still in use, but are considerably dilapidated. Almost all of the facilities – pumps and electrical facilities, civil and building structures – require renewal and rehabilitation. Although the intake water of Boz-su WTP has higher turbidity than that of Kadirya WTP, sufficient water treatment is practiced, resulting in the delivery of good quality water to the city central area. This WTP is located in a higher area in the city, but pumps are still required to enable the water supply to reach the surrounding areas.

iii) Water quality for both WTPs

The raw -water quality and the manner for controlling water for both WTPs are described below:

- Intake water quality of each WTP is shown in Figure 2.3.10 and Table 2.3.10. The turbidity during spring is higher than in other seasons, because of increased water flow (caused by melted snow from the in mountainous areas are) as well as mud that settles on the bottom of the canal. On the average, the turbidity of Boz-su WTP is higher than the Kadirya WTP, but the peak value of Kadirya is bigger;

- Each of WTPs has a laboratory assigned to analyze the treatment process;

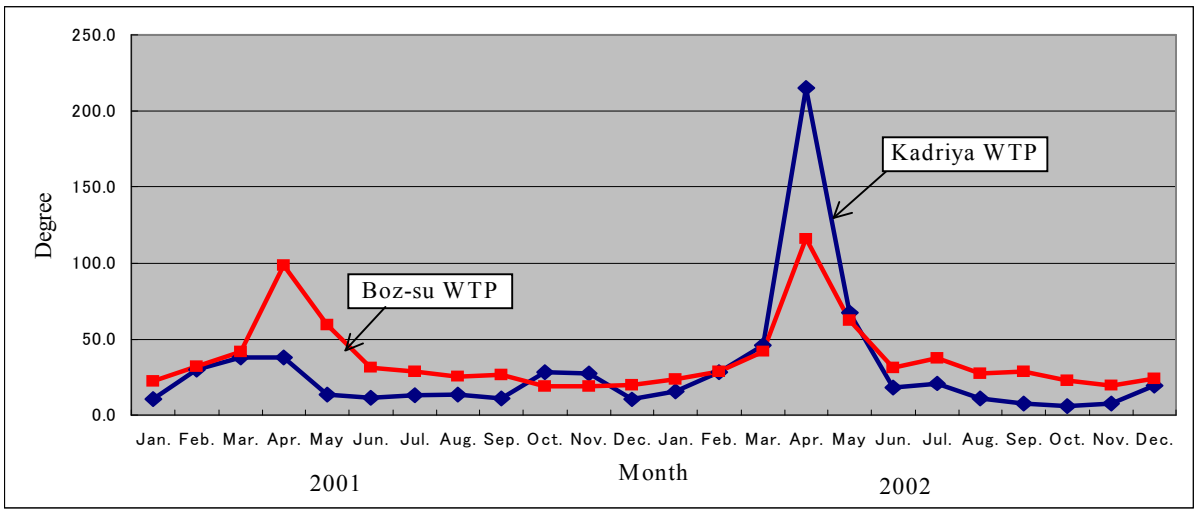


Figure 2.3.10 Monthly Average of Turbidity at Kadriya and Boz-su WTP (Source: Vodokanal)

Table 2.3.10 Intake Water Quality of Kadirya and Boz-su WTP

WTP name	Year	Number of colonies	Coli- index Number	Turbidity Degree*1	Ammonia mg/L	Nitrites mg/L	Chlorides mg/L	Hardness meq/L*2	Alkalinity mg/L	pH ---
Kadirya	Range	Annual range			Annual monthly average range					
	2001	1-244	500-24,000	7-407	0-0.005	0-0.005	2.63-3.25	1.35-2.08	1.75-2.69	7.94-8.5
	2002	0-127	0-240,000	3-9200	0	0-0.01	2.73-3.12	1.47-1.73	1.76-2.52	7.35-8.53
Boz-su	Range	Annual range								
	2002	122-395	>2380	9-1370	0-0.08	0-0.004	3-5.1	1.8-3.3	1.8-2.8	7.5-8.1

Note: *1: GOST turbidity standard water in battles are used for decision of Turbidity
*2: * 1 mol-equivalent of Na_2CO_3=atomic number 53

- Although the raw water's turbidity of Boz-su WTP is higher than that of Kadirya WTP, the transparency of treated water of Boz-su WTP is better than that of Kadiyra WTP due to high injection rate of coagulant; and
- On February 25th in 2004, the Team carried out water analysis for raw water taken from the Boz-su Canal. Raw water quality of Boz-su WTP located down -stream of Kadirya WTP was affected by sedimentation sludge discharge and water used to wash the filters of Kadirya WTP. As the results of this, coagulant injection ratio of Boz-su WTP is higher than Kadirya WTP, although there is no problem when it comes to the raw water quality of both WTPs. The results of the analysis made by Vodokanal are shown in S 2.3.5.

2) Groundwater treatment plants

There are six groundwater treatment plants in Tashkent City, and the specification of each plant is shown in Table 2.3.11. The process flow of Kibray, South, Sergeli and Bectemir WTPs, which have distribution reservoirs and distribution PSs, is shown in Figure 2.3.11 (1). Kara-su and Kuiluk WTPs directly distribute water to the City, as shown in Figure 2.3.11 (2).

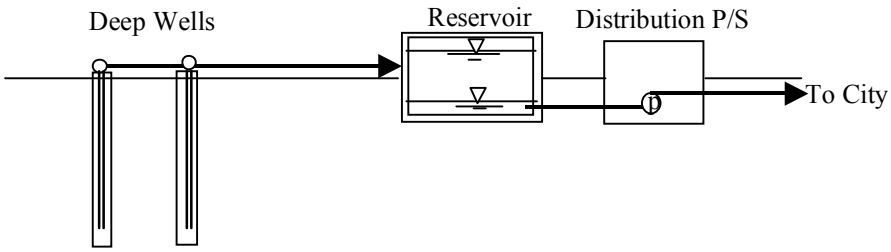


Figure 2.3.11 (1). Flow Sheet of WTPs with Distribution PS

Kibray WTP is the second biggest treatment plant in the City and has a wide distribution area, while other groundwater WTPs distribute only to their immediate surroundings. The Kibray WTP layout plan is shown in Figure2.3.12, provided as a sample of a groundwater treatment plan. The water quality of wells in 2003 is shown in Table 2.3.12.

Figure 2.3.11 (2). Flow Sheet of WTPs Directly Distributing to the City

Table 2.3.11 Specifications of Groundwater WTPs (Source: Vodokanal)

Division	Item		Kibray	South	Sergeli	Kara-su	Kuiluk	Bectemir
General	Design capacity (1000m^3/d)		455.2	143.0	40.0	52.0	20.0	20.0
	Actual production (1000m^3/d)		310-479(353)	198-124(142)	15.5-31.1(22.9)	24.7-35.2(28.7)	13.3-26.2(19.9)	14-15
	Water intake right (1000m^3/d)		992	160.4	39	----	69.12	----
	Site area (ha)		986	60	13	41	25	2
	Construction year		1955	1961	1966	1960	1962	1966
	Distribution area		Southern area of city	Chilanzar + Sergeli	Sergeli District	Surrounding area		
	Distribution reservoir	Volume (m^3)	10000	10000	4000	----	----	1000
		Elevation (m)	495	420	400	420	420	400
	Capacity of distribution PS (m^3/hr)		11,300m^3/hrx52mH + 12,900m^3/dx52mH	4000m^3/hrx100mH+ 3600m^3/hrx55mH	9900m^3/hrx30m			960m^3/hrx50mh+ 60m^3/hrx100mh
	Disinfection		By liquid chlorine	by liquid chlorine	by liquid chlorine	by hypo-chlorine	by hypo-chlorine	by hypo-chloride
	Laboratory		Operating	Operating	Operating	Not existing	Not existing	Not existing
Well's Informa-tion	Wells number		95	41	9	11	9	11
	Distance of wells (m)		100-300	100-150	44-200	>400	>180	80-100
	Operating wells number		63	27	8	6	9	5
	Wells elevation (m)		496-524	----	----	----	----	----
	Wells depth (m)		30-80	50-64(55.5)	40-104(64.9)	48or50	50-56(54.9)	----
	Wells diameter (mm)		350-600	300-400	150-400	300-600	300-400	----
	Screen depth (m)		2-47(38.2)	19-59(55.5)	21-94.5	>30	18-51.6	----
	Screen length (m)		7-47(21.3)	20-36(29.2)	18-35(25.8)	>15m	20-31.3(27)	----
	Casing material		Steel pipe					
	Screen type		Bored pipe (hole diameter 14mm, hole area ratio >20%)					
	Test yield (m^3/hr)		65-690(401)	36-306(174)	120-300(254)	----	106-254(202)	----
	Static water level (m)		0.4-7.4(5.2)	1.3-4.5(2.6)	1-5(1.7)	----	3.4-7.5(4.8)	----
	Draw-down (m)		0.4-10(4.8)	1.2-12(3.8)	0.8-1.8(1.2)	----	1.0-10(2.7)	----
	Specific capacity (L/s/m)		8-96(52,4)	2.3-50(22.3)	33.3-83.3	----	5.4-100(41.6)	----
	Pump capacity	Q (m^3/hr)	201-600	270-360	160-360	160-425	270-360	160
		H (m)	20-30	30-46	46	30-46	30-46	30-46
		Power (kw)	30-75	45-75	32-75	32-132	45-75	32-45
	Problem of water quality		High Nitrate	High hardness	High hardness Coliforms	High hardness Coliforms	High hardness Coliforms	High hardness

(Average)

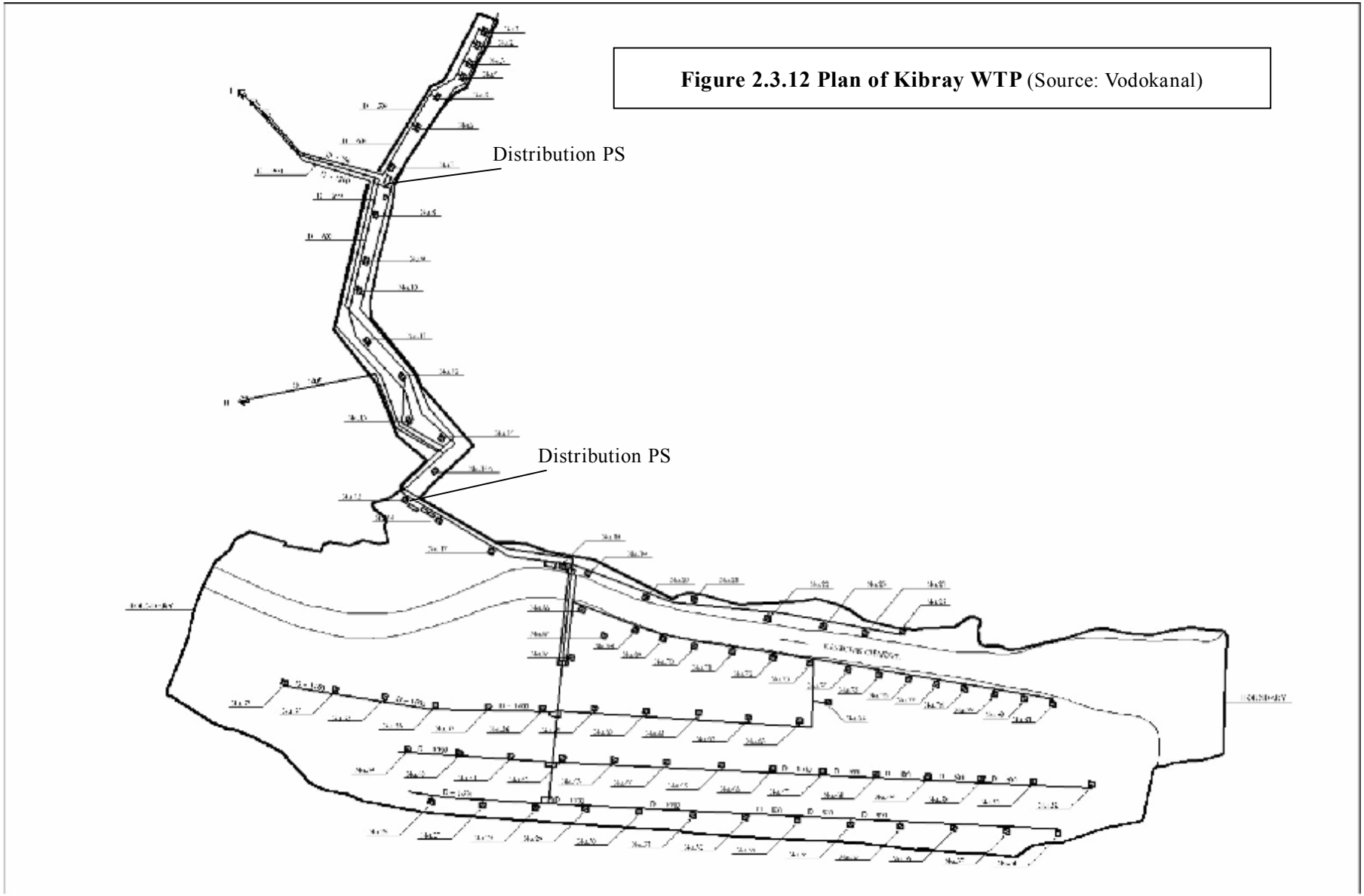


Figure 2.3.12 Plan of Kibray WTP (Source: Vodokanal)

Table 2.3.12 Groundwater Quality for WTPs in 2003 (Source: Vodokanal)

WTP name			Kibray (right bank)			Kibray (left bank)			South			Sergeli		
Analyzed well number			20			32			24			7		
Constituent	Unit	Standard value	Average	Range	Out of standard	Average	Range	Out of standard	Average	Range	Out of standard	Average	Range	Out of standard
Temperature	degree		---	---		---	---		16.8	14-18.4		15.9	12-18	
Color	degree	20	0	0		0			0	0				
Taste	number	2	0	0		0			0	0				
Odor	number	2	0	0		0			0	0				
Turbidity	mg/l	1.5	0	0		0			0	0		0.0	0-1.02	
pH value	--	6 - 9	7.2	7.15-7.25		7.4	7.17-7.5		6.2	5.9-6.6		7.3	6.5-7.8	
Alkalinity	meq/l	---	---	---		---	---		5.4	4.6-6.1		4.7	3.8-5.0	
Total Hardness	meq/l	7	5.9	5.75-6.4		4.0	3.1-4.5		7.7	6-10.2	22	6.5	5.8-7.6	
Ammonia (NH_4)	mg/l	0	0	0		0	0		0.0	0		0.0	0	
Nitrite (NO_2)	mg/l	3	0	0		0	0		0.0	0			0-0.002	
Nitrate (NO_3)	mg/l	45	36.9	20-57	8	8.0	5.31-12.55		25.0	14.8-36.3		23.6	21.2-33.67	
Chloride (Cl)	mg/l	250	9.9	7.5-11		10.4	9.5-14		24.3	16.33-33.16		19.1	14.26-23.03	
Total Iron (T-Fe)	mg/l	0.3	0	0		0	0		0.0	0		0.0	0	
Sulfate (SO_4)	mg/l	400	65.0	46-78.5		51.1	41.5-67		---	---		108.1	74.1-213.3	
Fluorine (F)	mg/l	0.7	---	---		---	---		59.8	29.95-83.73		0.28	0.13-0.4	
Total Solids (TDS)	mg/l	1000	411	380-432		223	158-260		527.1	362-802		424.0	260-476	
Total Bacteria	no./ml	100	---	---		---	---		---	---		0.4	0-4	
Total Coliform	no./1000ml	3	---	---		---	---		3.0	3		3.0	M3-3	

WTP name			Kuiluk			Kara-su			Bectimir		
Analyzed well number			6			5			5		
Constituent	Unit	Standard value	Average	Range	Out of standard	Average	Range	Out of standard	Average	Range	Out of standard
Temperature	degree		17.8	15-18		16.3	10-18		16.5	15-20	
Color	degree	20	0.0			0	0		1.8	0-18	1
Taste	number	2	0.0			0	0		1.4	0-35	
Odor	number	2	0.0			0	0		0.0	0	
Turbidity	mg/l	1.5	0.0	0-015		0	0		0.1	0-0.48	
pH value	--	6 - 9	7.3	6.8-7.5		7.4	6.9-7.8		7.5	7.2-7.8	
Alkalinity	meq/l	---	4.9	4.6-5.3		4.9	4.2-5.2		3.7	1.7-5.6	
Total Hardness	meq/l	7	6.8	6-8.4	1	6.5	5.7-8	2	4.9	3.0-6.2	
Ammonia (NH_4)	mg/l	0	0.0	0		0	0		0.0	0	
Nitrite (NO_2)	mg/l	3	0.0	0-0.01		0	0		0.0	0-0.004	
Nitrate (NO_3)	mg/l	45	27.3	23.92-32.54		29.6	27.3-44		13.9	5-26.1	
Chloride (Cl)	mg/l	250	17.0	14.76-19.6		19.6	4.28-27.44		12.3	7.8-16.6	
Total Iron (T-Fe)	mg/l	0.3	0.0	0		0	0		0.0	0	
Sulfate (SO_4)	mg/l	400	59.1	37.5-105.8		51.3	43.5-101.6		37.4	29.2-45.3	
Fluorine (F)	mg/l	0.7	0.3	0.25-0.39		0.3	0.28-0.32		0.2	0.15-0.24	
Total Solids (TDS)	mg/l	1000	414.4	257-591		428.7	379-581		304.3	128-430	
Total Bacteria	no./ml	100	0.5	0-6		0.4	0-4		0.3	0-6	
Total Coliform	no./1000ml	3	0.0	M3-7		4.0	M3-7	2	0.0	M3-7	

i) Kibray WTP

Kibray WTP had been the main WTP of the City until the construction the Kadirya WTP. Vodokanal has the water right over 991,800 m^3/d as groundwater (Table2.1.5), which is much larger than the present design capacity of 455,200 m^3/d. Most of the equipment in Kibray WTP, however, has deteriorated and now requires urgent replacement/rehabilitation. Presently, 95 deep wells are installed for Kibray WTP located on both the right and left banks of the Chirchik River.

Twenty-six wells located on the right bank take groundwater from the Chirchik Valley aquifer. The production has been stable at approximately 150,000 m^3/day even when the river flow is low. The nitrate concentration at some wells on the right bank, however, exceeds the drinking water standards, as shown in Table 2.3.12. It was said that the nitrate was discharged from a chemical factory located upstream of Chirchik City. However, the concentration of nitrate has not decreased although the factory had been closed. Accordingly, the high nitrate concentration may come from fertilizers being utilized in the Chirchik Valley. Therefore, countermeasures must be put in place to meet the standard. The water with high nitrate concentration is distributed to the City after mixing it with the treated water from Kadirya WTP or yielded water from the left bank.

The wells on the left bank form four lines parallel to the Chirchik River with a length of 3-4 kms each. The nearest line from the river is located just beside the riverbank and the farthest one is 1,000 to 1,400 m away from the river. The well pumps break down frequently and half has not been maintained. In 2004, records show that the wells' operating ratio hovered around 40%. This is because the pumps do not have safety lock devices to prevent dry operation although a rapid drop of groundwater level in the wells frequently takes place during their operation. The reasons for the rapid drop of groundwater level are as follows:

1) The pump capacity far exceeds the actual yield capacity of wells.
2) The intervals of the wells are too short to draw the well's design capacity compared with the groundwater supply ability in permeation layers.

As a result, the total yield in 2004 stayed within 150,000-190,000m^3/d.

The 2004 records reveal that the total intake capacity of Kibray WTP ranges between 300,000 to 350,000 m^3/d. The quality of groundwater on the left bank is obviously better, with lower concentration of dissolved salt and nitrate, than that on the right bank, as shown in Table 2.3.12

Kibray WTP supplies treated water of 650,000-750,000 m^3/d to the City through the in-plant PS. This WTP receives 350,000-400,000 m^3/d from Kadirya WTP. Though Kibray WTP is located at a higher elevation to its supply areas in the city, which allows gravity flow to majority of service areas except for limited high elevation areas, it supplies all of its treated water by pumps in order to supply water to the said high elevation areas.

ii) South WTP

The South WTP distributes treated water mainly to the southwestern part of the City use of pumps. Groundwater taken from wells is not of the best quality, having a high degree of hardness. However, among all the WTPs in the City which have generally been experiencing decreasing production, the South WTP has relatively the most stable production volume. The condition of facilities such as the distribution PS, is so bad that major repairs and complete rehabilitation are necessary.The groundwater taken from wells has usually high degree of hardness; and the value in some WTPs exceeds the Standard. However, the water being distributed or supplied to the City from these wells meets the Standard when mix with other raw-water taken from various water sources.

iii) Other WTPs

Segreli, Kara-su, Kuiluk and Bectemir WTPs located in the southern part of the City, are in a low elevation area. All of them are groundwater treatment plants, and mainly distribute the disinfected water to the surrounding urban areas. The pumped water at South, Sergeli and Bectemir WTP is once stored in reservoirs and then supplied to the City. That of Kara-su and Kuiluk WTP is directly distributed by the well pumps. As shown in Table 2.3.11, age and serious deterioration of these WTPs have made breakdowns of well and distribution pumps a frequent occurrence.

The transparency of each groundwater source is quite high although there were not problems on color and odor. The hardness of groundwater taken from wells at WTPs in the City except for left bank at Kibray WTP is not only high, but also contains coliform. However, the water distributed from these WTPs meets the Standard when mixed with water yielded from all the other wells.

(iv) Common features

The following features have been commonly observed for groundwater WTPs in Tashkent City:

- The diameter of majority of wells is between 300 to 400mm and the intake capacity of the wells is from 150 to 600 m^3/hr;
- The well casing is of steel pipe, while screens to collect groundwater are made of perforated pipes;
- Pipe casings are washed by air lifting, and are conducted for most wells at least once a year. However, the capacities of many wells have decreased (some of them are only 20 to 40% compared to the test results conducted after construction);
- The distance between wells is usually short, or between 100 and 200m, causing water level to lower. Usually, a distance of 300 to 500m is necessary;
- Vertical centrifugal pumps, motors of which are installed on the ground, are used for the wells constructed before 1980. However, the parts for vertical centrifugal pumps, which operate quite stably, are difficult to obtain;
- Lately, many of the vertical centrifuge pumps were exchanged for submersible pumps because of the above reason;
- Submersible pumps, which were made in Russia, have frequently broken down;
- For many wells, excessively large capacity pumps were installed compared to the well's recommended yield capacity. For example: the pump capacity is 600m^3/hr while the wells' recommended yield capacity is 200m^3/hr, causing energy waste and abnormal vibrations as the discharge valves were too much closed (squeezed);
- On February 25th 2004, the Team analyzed water from the left bank of Kibray WTP and from a transmission pipe from some wells at South WTP. The water quality of Kibray

was good, except that the value of hardness and manganese exceeded the Drinking Water Standard. The results are shown in S 2.3.5.

(2) Water Distribution System

1) Layout of Water Distribution System

The layout of the distribution system with the location of the WTPs, major pipelines and booster PSs is shown in Figure 2.3.13.

The water distribution system of Tashkent City is composed of gravity pipelines, distribution PSs, pipeline network and booster PSs. Gravity pipelines come out from the reservoir at Kadirya WTP, which supplies up to 72% (60% according to Vodokanal in 2002) of the total water distributed to the City. Distribution pumps installed at Boz-su, Kibray, South and Sergeli WTPs with distribution reservoirs also supply water to the City. From Kara-su and Kuiluk WTPs, well pumps distribute water to the City directly. Kadirya and Kibray WTPs are located out of the City's boundary and in a highly elevated area. Kibray WTP receives treated water from Kadirya WTP, and distributes both its yield and other water it receives to the City. The total length of the pipelines is around 3,500kms.

2) Characteristics of the System

The characteristics of the Tashkent water distribution system are as follows:

- The whole pipeline network is integrated, and many gravity and pumped pipelines from WTPs supply water to this network. Therefore, the hydraulic condition in the network is so complicated that it is difficult to keep a proper pressure balance;
- The difference in elevation between the low water level of reservoir at Kadirya WTP (+543m) and the major distribution area (elevation from +400m to +495m) ranges from 140m to 55m;

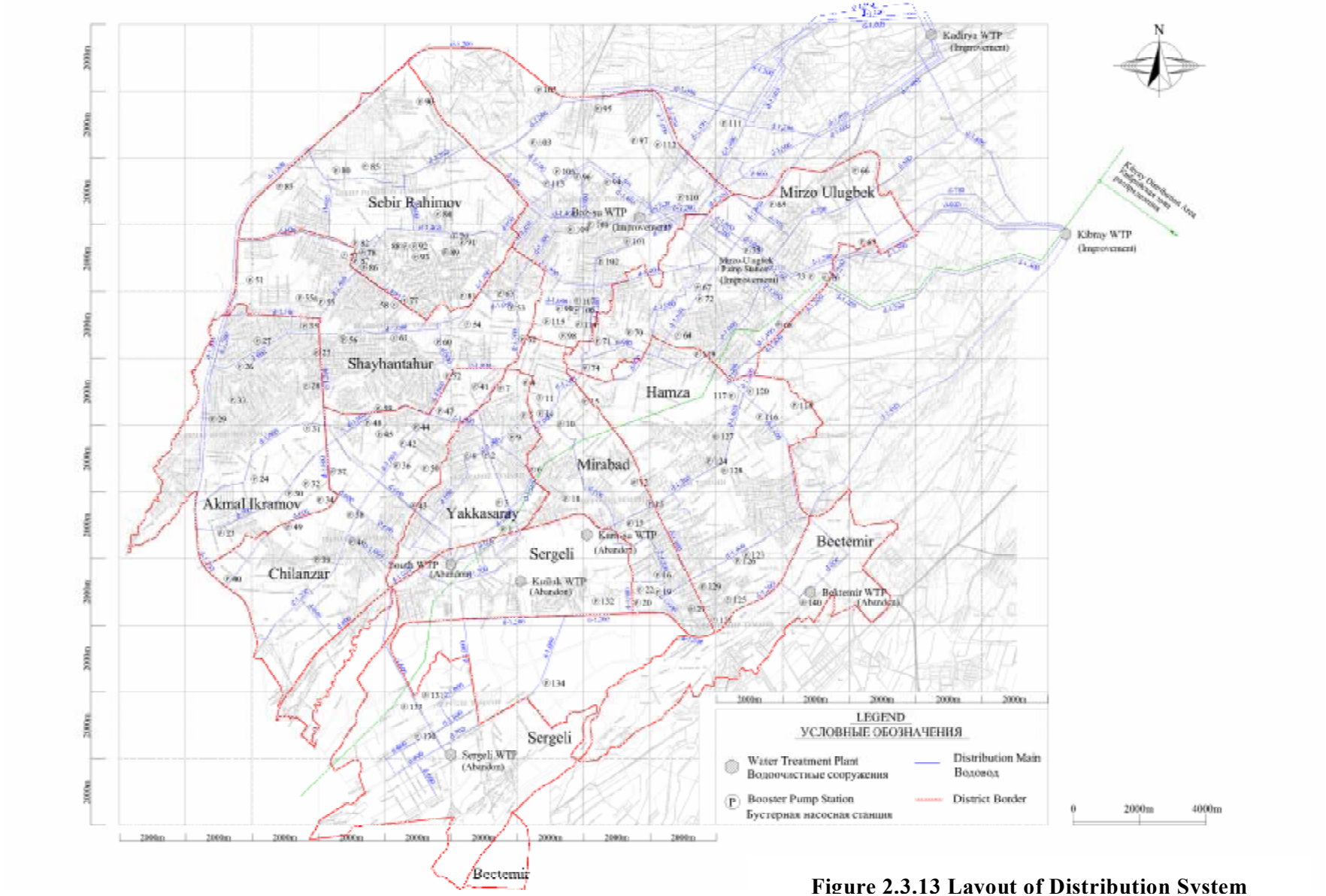


Figure 2.3.13 Layout of Distribution System

- The difference in elevation between Kibray WTP (+500m) and the major distribution area (elevation +400m to 440m) is from 100 to 60m; furthermore the water distribution from Kibray WTP is boosted by pumps;
- Current water pressure in the distribution network is mostly less than 26m of water head;
- According to a hydraulic calculation with a water distribution quantity of 2.9 million m^3/d, if the pressure in the pipelines is not regulated, the water pressure of 10-70m water head is assumed, which is the average actual distribution amount in 2002. This implies that damage may occur in pipelines and other distribution facilities located in high pressure zones;
- Therefore, Vodokanal operators regulate valves in the pipelines, to maintain the pressure in the City of 5-30m water head;
- Since this pressure is not sufficient to distribute water to apartment and other buildings of four to nine stories, more than 100 booster PSs were constructed in the city;
- Necessary supply pressure for apartment buildings is stipulated as follows:

  Necessary pressure = 10m + (story-1) x 4m

  Almost all buildings in Tashkent City, including apartment buildings, are classified into 2-, 4-, 5-, 9-, 12- and 16-story buildings.

  Buildings over 10 floors need to be installed with booster pumps. Therefore, Vodokanal needs to distribute water to the buildings not higher than nine floors.

  Necessary pressure for 4-, 5- and 9-story buildings, which compose 94% of all buildings is shows in Table 2.3.13;

Table 2.3.13 Necessary Pressure for Buildings

Story	Necessary pressure (m)
4	22
5	26
9	42

- Many pipeline as well as pumps for distribution and boosting, are deteriorated and frequently break down;
- Water quality in distribution network is good as shown in analysis results in S 2.3.5.

3) Distribution Facilities

i) Water Balance of Distribution System

The flow balance of water distributed in the City is shown in Figure 2.3.14.

As it is shown in the figure, water supply is produced by eight WTPs, and these WTPs and Mirzo-Ulugbek PS distribute the water to the City. Treated water is transmitted from Kadirya to Kibary, from Kibray to Sergeli and Bectmir, and form Kadirya to Mirzo-Ulugbek.

Water balance of the City and the retention time of reservoirs located in WTPs and PS are calculated in Table 2.3.14.

The retention time of distribution reservoirs is calculated to be only 0.3 to 2.8 hours (average 0.9 hrs).

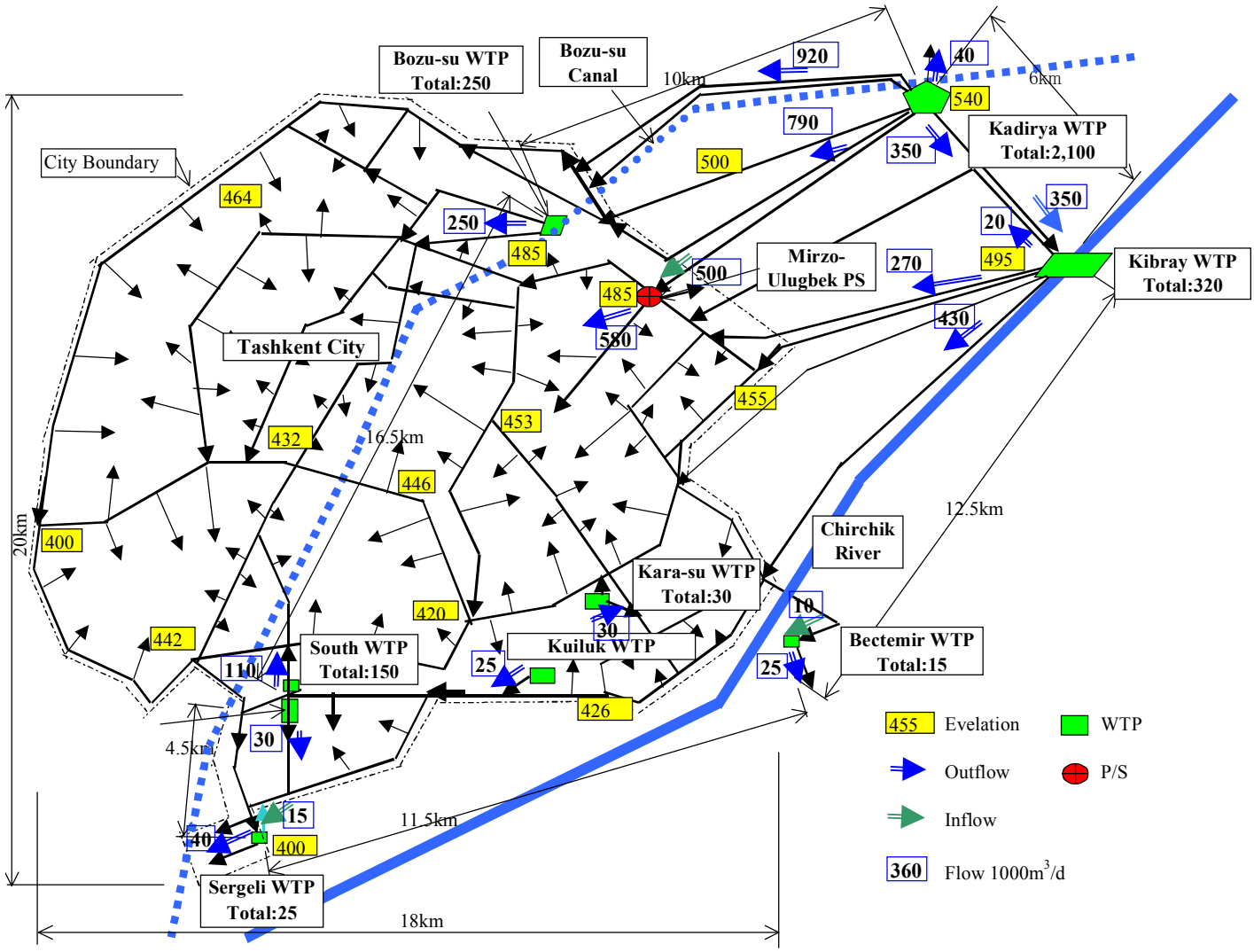


Figure 2.3.14 Water Distribution Balance in the City

Table2.3.14 Calculation of Water Balance in the City

Name	Supply capacity		Elevation (m)	Transferred water		Distribution capacity		Reservoir	
	Design (1000/ m^3/d)	Actual Average (1000/ m^3/d)		Water Source	Quantity (1000m^3/d)	Total (1000 m^3/d)	To City directly (1000m^3/d)	Volume (1000m^3)	Retention time (hr)
Kadirya WTP	1,375.0	2,100	540			2,100	1,220	30	0.3
Kibray WTP	455.2	340	500	Kadirya	380	720	695	10	0.4
Boz-su WTP	235.6	230	485			230	250	30	2.9
South WTP	143.0	140	420			140	150	10	1.6
Sergeli WTP	40.0	25	400	Kibray	15	40	40	4	2.4
Kara-su WTP	52.2	25	420			25	25		
Kuiluk WTP	25.0	25	420			25	25		
Bectemir WTP	25.0	15	400	Kibray	10	25	25	1	1.0
Mirzo-Ulugbek PS			485	Kadirya	500	500	500	20	1.0
Total	2,351.0	2,900			905	3,805	2,900	105	0.9

ii) Distribution Pipeline Network

The location of the major network pipelines for Tashkent City is shown in Figure 2.3.13. The pipelines are listed in Table 2.3.15 with length, diameter range, age after installation and materials. The total length is around 3,500km, and 67% of them are steel pipes and 32% are cast iron pipes. Fourteen (14)% of them have been in use for over 40 years.

Table 2.3.15 Pipeline List in Tashkent City (Unit: km)

Diameter (mm)	Total			Under 20Years*1			20 - 40years*1		More than 40years *1,*2	
	Steel	Cast iron	Others	Steel	Cast iron	Others	Steel	Cast iron	Steel	Cast iron
19-100	739.2	270.8	1.2	226.1	32	1.2	379.1	165.5	134	73.3
125-200	497.3	436.6	0	248.5	45.8	0	218.7	285.4	30.1	105.4
250-400	543.2	313	1.9	276.2	36.8	1.9	243.7	183.6	23.3	92.6
500-900	206.6	110.8	9.1	85.6	2.1	9.1	113.7	71	7.3	37.7
1000-1800	358.9	0.7	5	87.9	0	5	271	0.7	0	0
Sub-total	2345.2	1131.9	17.2	924.3	116.7	17.2	1226.2	706.2	194.7	309.0
Total	3494.3			1058.2			1932.4		503.7	

(Source: Vodokanal),
*1: Past years after installation
*2: Pipes past 40 years should be targets for replacement of Vodokanal

iii) Booster Pump Stations

The booster PSs including Mirzo-Ulugbek PS are listed in Table 2.3.16. There are 134 pumping stations, and 51 of them are small scale, or producing less than 100m^3/day. Most of the PSs, except Mirzo-Ulugbek, get water from the distribution pipes directly and boost water pressure of pipes as shown in Figure 2.3.15.

Table 2.3.16 List of Booster PSs

Capacity: m^3/hr	Number	Total capacity		Pump number	Average pump head: m	Location
		m^3/hr	1000m^3/d			
30,000	1	30,000	720	8	51	Mirzo-Ulugbek
7,200	1	7,200	173	9	90	Chilanzar
3,000	5	15,000	360	6-8	53	Sergeli & Others
1,000	43	43,000	1,032	3-7	49	All around city
800	3	2,400	58	2-4	50	All around city
600	11	6,600	158	2-10	45	All around city
500-300 (402)*	9	3,618	87	2-5	43	All around city
200-100 (164)*	10	1,640	39	2-5	35	All around city
Under 100 (38)*	51	1,938	47	1-5	38	All around city
Total	134	111,396	2,674			

Source: Vodokanal, ( )* Average ,

The booster PSs are needed to supply an apartment of not more than five floors, as well as six to nine floor buildings if water pressure is less than 26 m. Water can be distributed by gravity directly for some of the four and five-story apartment buildings in the relatively high-pressure zones of the distribution network. However as mentioned sub-section 2), the water pressure of majority of the areas is less than 26 m.

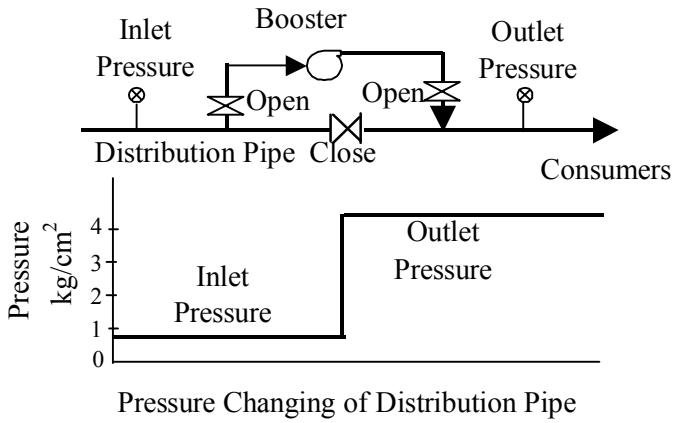


Figure 2.3.15 System of Booster Pump Stations

As mentioned in Section 2), since booster pumps are already installed for building over 10 floors, water supply need not to be boosted.

The majority of booster PSs distribute, where four, five and nine-floor apartment buildings are located. Some PSs distribute to the areas composed of lower than five-storey buildings. The water consumption by apartment residents in the city is 650,000m^3/d in 2002, as shown in Table 2.3.8 (Chapter 2.3.4).

Current daily factor is around 1.07, and hourly factor is 1.03,
Hourly maximum consumption = 650,000x1.07x1.03=716,000m^3/d=30,000m^3/hr

Compared to this figure, the total capacity of PSs (2,674,000m^3/d) is too big, as shown in Table 2.3.16. Therefore, although some PSs will be necessary in the future, their allocation and system need to be rationalized.

2.3.6 Operation and Maintenance (Details referred to S 2.3.6)

(1) Water Quantity and Quality Control

1) Water Quantity Control

The production capacities of all WTPs in Tashkent City for the year 2003 are shown in Table 2.3.17. Their actual capacities, except for Kadirya WTP, are derived from Vodokanal's data; however, that for Kadirya WTP was estimated by the Study Team.

Table 2.3.17 Water Production of WTPs in Tashkent City

Division	Name	Production capacity			
		Design capacity ($1000m^3/d$)	Share (%)	Actual production amount ($1000m^3/d$)	Share (%)
Large-scale WTP	Kadirya	1,375.0	58.5	2,200.0	71.0
	Kibray	455.2	19.4	350.0	11.3
	Boz-su	235.6	10.0	260.0	8.4
	Sub-total	2,065.8	87.9	2,810.0	90.7
Small-scale WTP	South	143.0	6.1	160.0	5.2
	Sergeli	40.0	1.7	45.0	1.5
	Kara-su	52.2	2.2	35.0	1.1
	Kuiluk	25.0	1.1	35.0	1.1
	Bectemir	25.0	1.1	15.0	0.5
	Sub-total	285.2	12.1	290.0	9.3
Total		2,351.0	100.0	3,100.0	100.0

The basis of the estimates is described as follows:

- Based on pump operation records and the actual flow measured during the previous JICA Study (1999) and this Study (January 2004), the distribution flow from Kadirya WTP to the City was around 2.1-2.2 million m^3/day as shown in Table 2.3.18 (Details are described in S 2.3.6);

Table 2.3.18 Comparison of Data of Water Distribution Amount (1000 m^3/day)

Water sources	Measured in 1999 Summer season	Vodokanal average data			Measured in 2004 Winter season	Estimation in 2004	
		2000	2001	2002		Maximum	Average
Kadirya WTP	2,200	1,360	1,342	1,242	2,160	2,200	2,100
Other WTPs	940	924	870	824	---	900	800
Total	3,140	2,284	2,212	2,067	---	3,100	2,900

- As it is shown in Table 2.3.19, if the data of Vodokanal will be employed, the loss from distribution network will amount to only 15.9%. However, the flow pattern of distribution to the City is almost flat all day long, signaling that a huge amount of water loss due to leakage and wastage. Accordingly, the water distribution amount of Vodokanal's data , as shown in Table 2.3.18, may be too small, and the value estimated by the Study Team is judged to be rational; and

Table 2.3.19 Calculation of Water Losses in Distribution Lines

Item	Amount ($1000m^3/d$)	Loss ($1000m^3/d$)	Rate (%)
Actual consumption in the city	1,739[*1]	---	---
Distribution from Vodokanal data	2,067	328	15.9
Estimated actual distribution	2,900	1,161	40.0

[*1]: this value is taken from Table 2.3.8

- The unit power consumption of Kadirya WTP has been checked as follows: Electricity is consumed mainly by intake pumps at Kadirya WTP, and consumption of which is as follows: No.1 Pump head - 25 m (actual - 19.3 m) and No.2 Pump head - 18 m (actual - 12.3 m)

Actual No.1 pump intake amount - 58% and No.2 pump - 42%

$kW = 0.163 \times QH/\eta$ $Q=1m^3/hr$, η : efficiency $= 0.7$

$= 0.163 \times 1/60 \times (25 \times 0.58 + 18 \times 0.42)/0.7 = 0.0856 kWh/m^3$

Other consumption in the WTP is assumed at around 10 to 20 % of the above power consumption, and in this case the total unit consumption is computed as shown as follows:

Total unit consumption =0.0856 x (1.0+(0.1 to 0.2)) = 0.094 to 0.103

If water production at the Kadirya WTP is 2.1 million m^3/d, the unit electricity consumption is 0.105 kWh/m^3 as shown in Table 2.3.24 indicating that the amount of water being distributed is correctly estimated.

The management of Vodokanal disagrees to the estimates on the daily average distribution amount made by the Study Team, and asserts that the value should be 2.5 million m^3/d. They presented the records that measured the amount distributed from Kadirya WTP on 20th December 2004, which was 1.83 million m^3/d, as shown in S 2.3.6.

2) Water Quality Control (Details are referred to D2.3.6)

Providing safe drinking water that conforms to the highest standards of water quality is one of the most important elements in water supply. For groundwater, the only treatment is chlorine disinfection. As for surface water supplied to WTPs, water quality is carefully controlled by the coagulant dosing ratio and chlorine injection ratio, because raw water quality at the WTPs fluctuates.

Quality control for the surface water at the WTPs is conducted as follows:

- The watershed of the Chirchik River, which is the major water source of Tashkent City, is proclaimed a conversation and protected area by the Uzbekistan Government;
- Sampling points, items, and frequency for each WTP are shown in Table 2.3.20, and water quality should comply with the Drinking Water Standards, as shown in Table 2.3.21;
- When the turbidity of raw water is over 15 degrees, coagulation is conducted in Kadirya WTP, and injection ratio is decided based on the simple jar tests for raw water;
- Chlorine dosing ratio is decided based on the hourly test results of residual chlorine;
- The quality of water being distributed must comply with the Drinking Water Standard; and
- The maximum turbidity in Boz-su canal sometime exceeds 12,000 degrees in the Spring season, and dosing ratio of coagulant should be decided carefully in this case.

Table 2.3.20 Sampling Points, Frequency and Analysis Items

Division	Sampling point	Hourly	Daily	Monthly		2 times/y
Kadirya WTP	Raw water		1-3 times/d: Temperature, Turbidity, Odor, Taste, Color, pH, Ammonia, Nitrite, Nitrate, Alkalinity, Chloride, Hardness	Hardness, Chloride, Sulfate, F, Fe, Solid total dissolved, Colonies quantity, Cu, Mb, Poly-P, Z, As, Mn	BOD, DO, SAS,	
	After sedimentation				Radiation,	
	Distribution pipes	Residual chlorine				
	After filtration	Temperature, Turbidity				
Boz-su WTP	Raw water		2times/d: Temperature, Turbidity, Odor, Taste, Color, pH, Ammonia, Nitrite, Nitrate, Alkalinity, Chloride, Hardness	Hardness, Cl, S、F, Fe ,Solid total dissolved, Colonies quantity, Cui, Mb, Poly-P, Z, As, Mn,	BOD, DO, SAS, Transparency	
	After sedimentation					
	Distribution pipes	Residual chlorine	Coli-index		Radiation	
	After filtration	Turbidity	Coli-index			
Ground-water WTPs	Distribution pipes	Residual chlorine	Temperature, Coli-index	Temperature, Turbidity, Odor, Taste, Color, pH, Ammonia, Nitrite, Nitrate, Chloride, Colonies quantity, S, F, Fe, Solid total dissolved, Radiation		Cu, Mb, Z, As, Cl

(Source: Vodokanal)

(2) Facilities Operation

1) Staffing for Water Supply Facilities

Staff assignment for each facility is shown in Table 2.3.22. There is total of 1,700 staff members for all the facilities, and four staff members operate in each shift. Each staff member also works 12 hours per shift. The table also reveals the distributed water volume per staff, showing that large-scale plants have a much bigger ratio than the smaller plants. In the table, the distributed water volume per staff of Sergeli WTP is the least, because half of the staff is engaged in repair works for the distribution network in Sergeli district.

Table 2.3.21 Quality Standard for Drinking Water

Indices or components	Unit	Standard	Analysis method
1. Microbiological indices			
1.1 Total bacteria number	Microbe quantity in 1ml. of water	not more than 100	GOST 18963-73, ISO 8360/1-2-88
1.2 Number of coliform group	Quantity in 1000 ml. of water	not more than 3	GOST 18963-73, ISO 9308/1-2-90
1.3 Number of fresh fecal coliform	Quantity in 300 ml. of water	Not detected	GOST 18963-73, SO 9308/1-2-90
1.4 Kolifags	BOE quantity in 200 ml. of water	Not detected	Methodical instructions, approved by Ministry of Health of Republic of Uzbek.
2. Parasitological indices			
2.1 Pathogenic bacteria	Cyst quantity in 25 l. of water	Not detected	Methodical instructions, approved by Ministry of Health of Republic of Uzbek.
2.2 Heminth ovums	Ovum and larvae quantity in 25 l. of water	Not detected	-Ditto-
3. Toxicological indices			
a) Inorganic components			
3.1 Aluminum (Al)	mg/l	0.2 (0.5)[*4]	GOST 18165-89
3.2 Beryllium (Be)	Ditto	0.0002	GOST 18294-81
3.3 Boron (B)	Ditto	0.5	ISO 9390-90
3.4 Cadmium (Cd)	Ditto	0.001	ISO 5961-85
3.5 Molybdenum (Mo)	Ditto	0.25	GOST 18308-72
3.6 Arsenic (As)	Ditto	0.05	GOST 4152-81
3.7 Nickel (Ni)	Ditto	0.1	ISO 8288-86
3.8 Nitrates (NO_3)[*1]	Ditto	45	GOST 18826-73
3.9 Nitrites (NO_2)	Ditto	3	GOST 4192-82
3.10 Mercury (Hg)	Ditto	0.0005	ISO 5666/3-84
3.11 Lead (Pb)	Ditto	0.03	GOST 18293-72
3.12 Selenium (Se)	Ditto	0.01	GOST 19413-89
3.13 Strontium (Sr)	Ditto	7	GOST 23950-88
3.14 Fluoride (F)	Ditto	0.7	GOST 4386-89
3.15 Chromium (Cr^{+6})	Ditto	0.05	ISO 9174-90
b) Organic components			
3.16 Benzol	mg/l	10	Meth. instr. appr. by Min. of Health of Rep.of Uzb.
3.17 Benzapilene	Ditto	0.01	-Ditto-
3.18 Polyacrylamide	mg/l	2	GOST 19355-85
3.19 Pesticides 6)	mg/l		Meth. instr. appr. by Min. of Health of Rep.of Uzb.
4. Others			
4.1 Taste	degree	2	GOST 3351-74
4.2 Odor	Ditto	2	-Ditto-
4.3 Turbidity[*2]	mg/l	1.5/2.0/[*5]	-Ditto-
4.4 Color	degree	20/25/[*6]	-Ditto-
4.5 pH value	pH	6-9	measured by pH-meter
4.6 General mineralization (solid residual)	mg/l	1000/1500/[*7]	GOST 18164-72
4.7 Iron (Fe)	mg/l	0.3/1.0/[*7]	GOST 4011-72
4.8 General hardness[*3]	Ca+Mg eqv/L	7/10/[*7]	GOST 4151-72
4.9 Manganese (Mn)	mg/l	0.1	GOST 4974-72
4.10 Copper (Cu)	Ditto	1	GOST 4388-72
4.11 Phosphate (PO_4)	Ditto	3.5	GOST 18309-72
4.12 Sulfate (SO_4)	Ditto	400/500[*7]	GOST 4389-72
4.13 Chloride (Cl)	Ditto	250/350[*7]	GOST 4245-72
4.14 Zinc (Zn)	Ditto	3	GOST 18293-72
4.15 SPAV (PAV)	Ditto	0.5	ISO 7875/1-2-84
4.16 Phenol	Ditto	0.001/0.1[*8]	ISO 6439-90
4.17 Mineral oil	Ditto	0.1	Meth. instr. appr. by Min. of Health of Rep.of Uzb.
5. Radioactive components			
5.1 Total alpha-radioactivity[*9]	Bq/l	0.1	ISO 9696-92
5.2 Total beta-radioactivity[*9]	Bq/l	1	ISO 9697-92

*1: Analyzed as NO_3^-, 45mg/L of the standard value is almost equivalent to the Japanese standard value of 10 mg/L for $N\text{-}NO_3$

*2: This value is analyzed in comparison with the water standard liquid of GOST, and is approximately 50% lower than the value analyzed by Japanese method when the value is low (less than 10 degree)

*3: The Uzbekistan standard of Ca + Mg equivalent with a value 7 as above, is equivalent to 294-350mg/L in $CaCO_3$ conversion (Japanese standard is 300mg/L)

*4: When high colored water is treated by coagulant

*5: When water is effectively disinfected

*6: When high color is treated and disinfected under the control of trihalomethane

*7: With only disinfection

*8: When water is not chlorinated

*9: Recommended by WHO Guideline (2^{nd} edition) , average intensity of α and β radiation

Table 2.3.22 Staff Assignment for Facilities

Facility	Qualification	Shift operator	Operator	Mechanic/ electrician	Laboratory Staff	Total	Capacity (1000/m^3/d)	Capacity/staff (1000m^3/d/staff)
Kadirya	All	88	60	21	11	180	1,375.0	7.64
Boz-su	All	51	45	33	11	140	455.2	3.25
Kibray	All	60	87	36	10	193	235.6	1.22
South	All	48	39	16	12	115	143.0	1.24
Sergeli	All	71	33	17	7	128	40.0	0.31
Kara-su	All	42	0	2	5	49	52.2	1.07
Bectemir	All	44	8	9	0	61	25.0	0.41
Kuiluk	All	21	5	9	0	35	25.0	0.71
PSs	All	585	173	36	0	794	2,351.0	2.96
Sub-total	Engineer	41	127	14	20	202	2,351.0	11.64
	Worker	969	323	165	36	1493	2,351.0	1.57
	Total	1010	450	179	56	1695	2,351.0	1.39
Others at offices excl. facilities	Engineer		0			959	2,351.0	2.45
	Worker		0			1757	2,351.0	1.34
	Total		0			2716	2,351.0	0.87
Total	Engineer		0			1161	2,351.0	2.02
	Worker		0			3250	2,351.0	0.72
	Total		0			4411	2,351.0	0.53

(Source: Vodokanal)

2) Facility Operation Method

Since all water supply facilities in Tashkent City are operated manually, these equipment such as pumps need to be constantly observed by operators necessitating a large number of shift staff whose major work is the observation of equipment. The details of operation and maintenance (O&M) works are shown in Table 2.3.23.

(3) Power and Chemical Consumption

Table 2.3.24 shows the power consumption by water supply facilities from 2000 to 2002, and the unit consumption per production volume of water. The Study Team has adopted 2.1 million m^3/day as the distribution quantity of Kadirya WTP.

Table 2.3.23 Details of O&M Works

Facilities name	Operation & Maintenance Items	
	Particular	Common
PS	-Switching ON/OFF based on order from engineer -Regulation valves -Checking facilities -Replacement of spare parts and oil/grease	-Operation observation -Measuring, recording and reporting for operation status, -Reporting abnormal condition, -Alarming emergency accident
Sedimentation basin	-Raw water observation -Observation of settling condition -Making decision of coagulant dosing ratio -Conducting dosing -Dissolving coagulant -Ordering coagulant -Operation of sludge dredger	
Rapid filter	-Operation observation -Switching valves for layer washing -Observation of washing condition -Checking filter layer -Replenishment of filter material	
Wells	-Operation observation -Switching ON/OFF based on order of engineer -Regulation valves -Pulling up, checking, replacing spare parts and oil/grease for pumps	
Disinfection	-Operation observation -Monitoring of residual chlorine -Regulating gas quantity -Setting gas cylinders -Ordering gas -Checking facilities -Replace spare parts and oil/grease	
Total Operation for WTPs	-Making daily/monthly report, -Evaluating operation condition, -Decision making for operation, -Investigation for abnormal condition, -Responding emergency alarm, -Conducting repair work, -Planning and conducting regular maintenance, -Ordering necessary materials and pars, -Formulating budget	
Booster PS and Distribution Networks Managing		

Table 2.3.24 Electricity Consumption for Water Supply System

Name	Electricity consumption 1000kWh/year			Distribution amount mil.m^3/year			Unit consumption kWh/m^3		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
Kadirya	80,227	81,198	80,294	766.5	766.5	766.5	0.105	0.106	0.105
Buz-su	25,812	25,447	25,138	93.1	91.2	85.3	0.277	0.279	0.295
Kibray	65,220	60,954	54,562	148.5	139.1	129.0	0.439	0.438	0.423
South	22,785	24,212	18,780	61.1	52.2	52.0	0.373	0.464	0.361
Others	7,248	6,801	7,038	34.5	35.0	34.5	0.210	0.194	0.204
Sub-total	201,292	198,612	185,812	1,104	1,084.0	1,067.4	0.182	0.183	0.174
PSs	75,445	77,729	88,827	1,104	1,084.0	1,067.4	0.068	0.072	0.083
Total	276,737	276,341	274,639	1,104	1,084.0	1,067.4	0.251	0.255	0.257

(Source: Vodokanal)

Figure 2.3.16 shows the monthly fluctuation of coagulant (aluminum sulphate) dosing ratio for surface WTPs. The figure shows that the dosing rate of Boz-su is much higher than that of Kadirya, especially in the Spring. Figure 2.3.17 also shows the monthly fluctuation of chlorine injection rates. The chlorine injection rates at groundwater WTPs are stable and lower than those of the surface water WTPs.

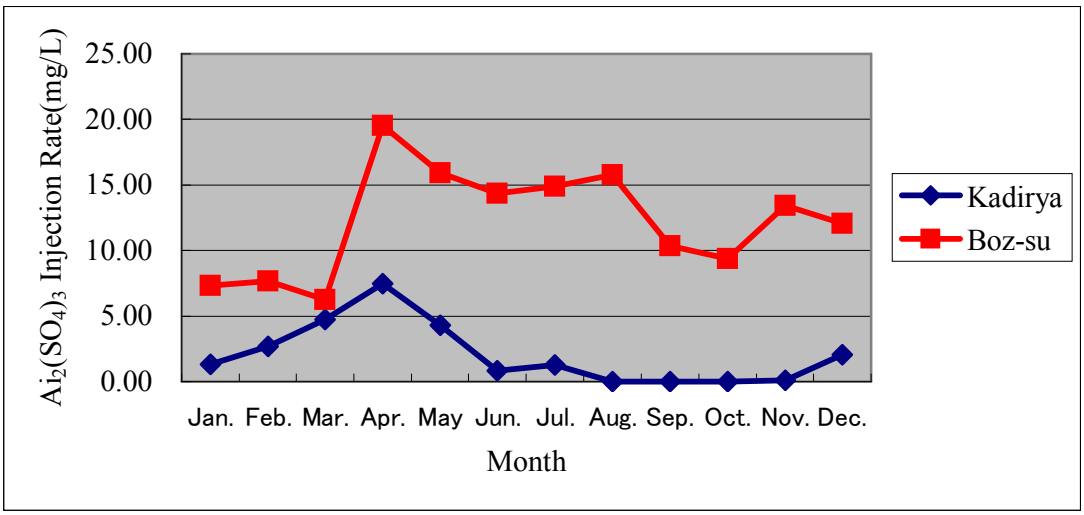


Figure 2.3.16 Coagulant Dosing Ratio for Surface WTPs

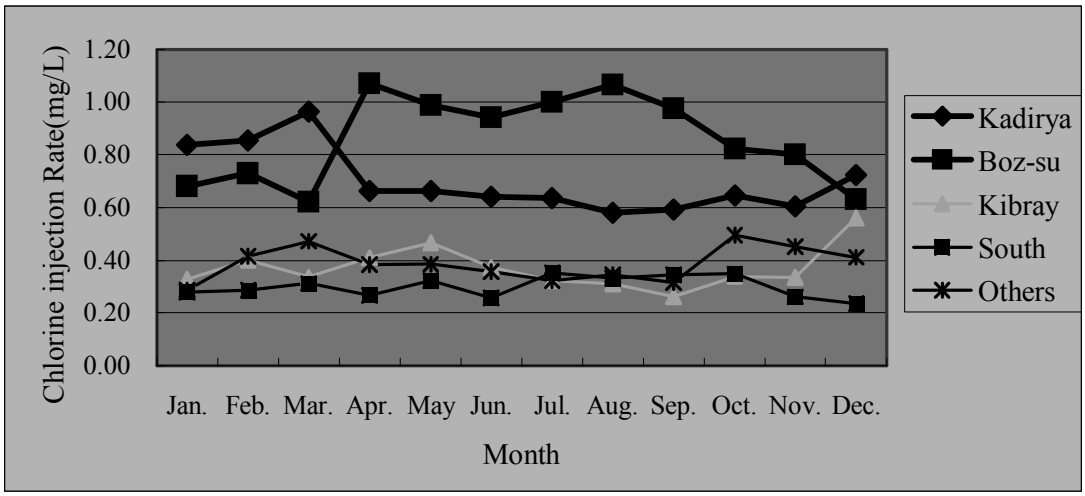


Figure 2.3.17 Chlorine Injection Ratio

Table 2.3.25 shows the chemicals' consumption and costs for WTPs. The overall per cubic meter unit costs of electricity and chemicals of Kadirya WTP is by far the lowest and those of Kibray are the highest. The reasons of low unit costs of Kadirya WTP are that distribution is done by gravity and the ratio of coagulant dosing is low.

Table 2.3.25 Chemicals and Electricity Consumption of WTPs

WTP	Chemical	2000	2001	2002					
		Chemical consumption (ton)			Annual cost (1000 USD)			Annual distribution (mil.m^3)	Unit cost (USD/ 1000m^3)
					Chemical	Electricity	Total		
Kadirya	$Al_2(SO_4)_3$	545.9	785.9	1533	165.3	634.3	883.3	766.5	1.2
	Liquid Cl	381.1	417.1	523.3	83.7				
Boz-su	$Al_2(SO_4)_3$	882.1	789.2	1048.7	113.0	198.6	323.4	124.8	2.6
	Liquid Cl	76.8	71.2	73.57	11.8				
Kibray	Liquid Cl	66.4	53.2	46.9	7.5	431.0	438.5	129.0	3.4
South	Liquid Cl	17.8	18	15.6	2.5	148.4	150.9	52.0	2.9
Others	Liquid Cl	3.8	3.5	3.43	0.5	55.6	65.8	34.5	2.9
	Hypochlorite	11.9	11.6	9.72	9.7				

Note: Liquid Cl: Liquid chlorine in 1 ton cylinder

2.3.7 Tariff

(1) Types of tariff

Approximately 16% of the total domestic consumers in Tashkent City are currently under the metered tariff system, while the rest are under the flat tariff (called "Norm") system. On the other hand, 80% of large consumers have been installed with meters, which cover close to 95% water consumption. The Norm rate depends on domestic consumers' lifestyle (e.g. with/without sewage, with/without hot water supply etc.). The tariffs were revised on the 1st July 2003 (see Table 2.3.26.).

Table 2.3.26 Tariffs as of July 1, 2003

Division	Consumers		Water Supply	Sewer Services
Norm (Flat rate)	Domestic		22 soum/m^3 x a* (liters/day per capita) x 365 days / 12months x the number of persons/1,000 + 10.5 soum/m^3 x b* (liters/day per capita) x 365 days / 12months x the number of persons / 1,000	
Metered rate	Domestic		22 soum/m^3	10.5 soum/m^3
	Industry	From Vodokanal to Subsidiary (Ulgurgisuvsavdo)	22 soum/m^3	10.5 soum/m^3
		From Subsidiary to Industry	39.66 soum/m^3	14.07 soum/m^3
	Communal Services		22 soum/m^3	10.5 soum/m^3

Sources: Vodokanal,

a* and b* are coefficient of consumption of water (ranging from 50 to 330 liters /day) and sewage water (ranging from 0 to 429 liters/day), respectively, which depends on the domestic consumer's lifestyle. (Refer to S 2-3-7-2 and S 2-3-7-3 in Volume 3 Supporting Report).

- Value Added Tax (VAT) rate of 20% is added on the amounts from users other than domestic consumers.
- Ulgurgisuvsavdo (a new subsidiary of Vodokanal) purchases water from Vodokanal at 22 soum/m^3 and sells it to clients at 39.66 soum/m^3.

With this last revision of the tariff table, water tariffs for domestic customers were increased while those for communal services were lowered. According to Vodokanal, effects of this revision were the following:

- Improvement in cash flows

  On the one hand, income has increased due to the higher domestic water charges, but on the other hand, the cash shortage problem for VAT payments has become avoidable (VAT is levied to the Vodokanal on the income amount from users on the accrual basis even if customers delay their payments to Vodokanal). Generally, water charges collection from the communal services is often delayed or is not practically possible

and it causes cash shortage problems for Vodokanal. Therefore, if the tariff level for the communal services becomes lower, the risk of such cash shortages will become lower too.

- Unified water tariff

  Before the revision, there was a considerable difference between the tariffs for domestic and industrial customers, which resulted in an excessive cross subsidy from the industry to the domestic customers. With the current unification of tariffs, this cross subsidy has been eliminated. However, water is sold by Tashkent Vodokanal to the industrial sector through its 100%-owned subsidiary (established in July 2003), whose costs are thus eventually transferred to the tariffs charged to the industrial customers. As a result, the tariffs charged to industrial customers are approximately 2 times higher (39.66 soum/m^3) than those charged to domestic customers.

In addition, water meter installation costs that were originally planned to be included in the water tariffs are charged to domestic customers separately since July 2003 (refer to Table 2.3.29). However, as of December 2003, the specific collection method has not been decided yet.

(2) Tariff Level

Apartment residents in Tashkent city make up 67% of the population. Their average water consumption under the current Norm system is 330 Lpcd. For a household of four family members, the tariffs would amount to 871 soum per month (22 soum/m^3 x 330 L x 30 days x 4 persons). According to the Statistics Department of Tashkent city, the average income for a family of four members in 2002 was 81,803 soum/month. Water tariff, therefore, accounted for a mere 1.1% of the average income of a family of four members, and if sewage tariff was included, it accounted for 1.6%. Based on a World Bank document, there is still some room to increase the tariffs if the tariff level of up to 3% of average income can be tolerated.[1]

[1] *Information and Modeling Issues in Designing Water and Sanitation Subsidy Scheme*. May 2000. The World Bank

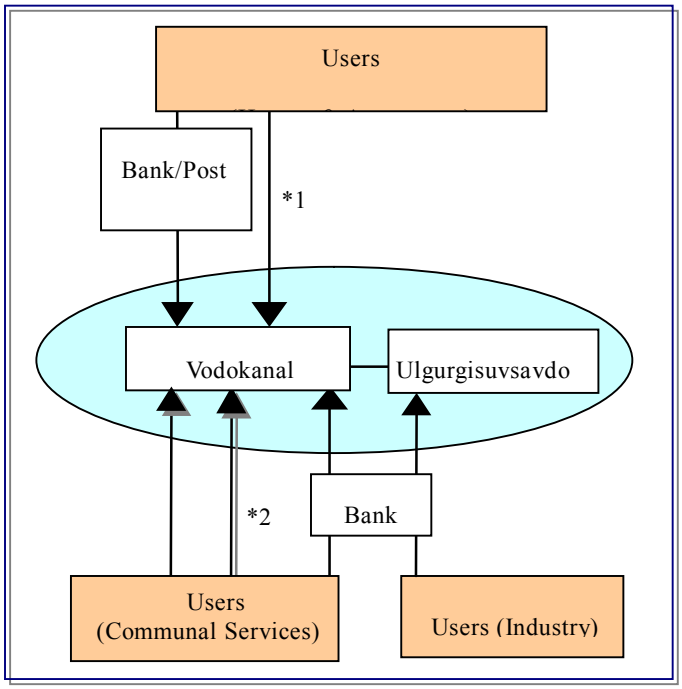
(3) Tariffs Revision Method

Vodokanal may revise the tariffs based on its calculation of the expected operation costs plus a profit margin of up to 10%. Tariff revisions are decided upon by the Central Finance Department of the *Hokimiyat* of Tashkent city after obtaining approvals from a number of other *Hokimiyat*'s departments, such as tariff revision and anti-monopoly departments.

(4) Payment Collection System

1) Outline of the Present Water Charges Collection System

An outline of the present Vodokanal payment collection system is illustrated in Figure 2.3.18. Water bills can be paid at banks, post offices and at Vodokanal. However, individual customers and small business owners who have a bank account are still limited, thus bills are often preferred to be paid directly at Vodokanal, or in the case of detached houses, directly to the inspectors (meter readers). When the Study was conducted in 2003, 35% of consumers living in apartments paid at banks or post offices, while 65% paid at Vodokanal or to the inspectors. On the other hand, in the case of consumers living in detached houses, the percentages were 3% and 97%, respectively. According to Vodokanal, the percentage of consumers living in detached houses who pay directly to the inspectors is estimated to be in the range of 50% to 70%. Lacking precise data, Vodokanal is not able to clearly differentiate between consumers who pay at Vodokanal's counter or directly to the inspectors. It must also be noted that inspectors can only read the meters when somebody is at home, because meters are in-



Note:
*1 50-70% of detached house users pay their bills to the inspectors
*2 is offset

Figure 2.3.18 Present Payment Collection System

stalled inside houses as a precaution against theft. This fact is common not only for water meters, but for electricity and gas meters as well.

2) Water Meters Installation Status

At present, water charges based on meters apply to about 32% of detached houses, 9% of apartments (individual meters), 73% of the communal service sector and 98% of industries in terms of the number of users, respectively. The Metered tariff system has only been introduced since 1999. Vodokanal has stopped installing bulk meters to each apartment building in 2002, and instead, has started to install individual meters in each apartment. Bulk meters already installed in apartment buildings are not used for calculation of water charges anymore. The meter installation progress for domestic customers is slow and far behind the original schedule. In 1999, it was planned that a total of 204,460 meters would be installed by 2002, whereas only 92,272 have been installed actually. In addition, according to a new installation plan made in 2003, the number of meters to be installed in 2003 is 107,901, but only 10,405 have been installed by the end of July.

Table 2.3.27 Meters Installation Plan for Domestic Customers (1999)

Note 1	Note 2	Water meters installation schedule in each year (Cumulative)					
		1999	2000	2001	2002	2003	2004
2,800	547,470	18,460 (18,460)	28,000 (46,460)	58,000 (104,460)	100,000 (204,460)	128,000 (332,460)	215,010 (547,470)

(Source: Preparatory Study Report, June 2003)

Note 1: The number of water meters installed as of 2.1.1999

Note 2: The Number of water meters to be installed from 1999 till 2004

Table 2.3.28 Meters Installation Plan for Domestic Customers (2003)

Note 1	Note 2	Water meter installation schedule in each year (Cumulative)			
		2003	2004	2005	2006
92,272	437,901	107,901 (107,901)	110,000 (217,901)	110,000 (327,901)	110,000 (437,901)

Note 1: The number of water meters installed as of 1.1.2003

Note 2: The number of water meters to be installed from 2003 till 2006

Currently, meter reading requires the customer's presence because the meters are installed within the boundary of the customer's house and the reading results must be

logged in the Log Book kept by the customer. Meter reading is done by Vodokanal or Ulgurgisuvsavdo inspectors.

The official meters installation schedule is shown in Table 2.3.28, whereas according to the latest Vodokanal schedule, meters installation will be completed by 2009.

Analysis of the water meters installation system

There is a need to have water meters installed outdoors, in order to improve the efficiency of their reading . The problem is that when a water meter is installed indoors, reading process cannot be performed smoothly during the householder's absence. As for detached houses, if Vodokanal's new installation method (refer to i) below) performs well both technically and in terms of costs, it would be preferable to start installing water meters outdoors for detached houses. As for apartments, outdoor installation is desirable, but there can be technical difficulties in implementing this method, especially in old apartment buildings. It could be desirable to install water meters in each apartment in terms of the water charges system based on the water consumption volume. However, it is difficult to say how far it could spread because of the cost issue.

Installation methods

The situation explained below represents the latest condition of the methods of water meters installation in both detached houses and apartments.

i) Detached houses

Although the main practice has been to install water meters inside detached houses so far, currently Vodokanal has got some ideas about changing this method. The new method purports changing of minor pipes and installation of water meters for several houses (e.g. for 10) in one box outside. A pilot project was completed on this issue in October 2003. According to Vodokanal's information, the results of this pilot project were good; however, the costs were several times higher as compared to the figures observed so far. Thus, it is necessary to consider whether funding resources will in fact be available, and whether there are any countermeasures to prevent frost and

other technical failures that might occur if water meters are installed outside the house.

ii) Apartments

It has been decided to stop installing bulk meters in apartment buildings since 2002, and now individual water meters are installed in each apartment. However, in case of old buildings, where each apartment might take water from different pipes, it is still to be decided whether a single water meter should be installed after connecting those pipes into one or each pipe should be equipped with a separate water meter.

3) Cost Share of Water Meter Installation

In terms of water meters installation, there are 4 categories of domestic customers in Tashkent City. The current cost sharing of a meter installation for each category is summarized in Table 2.3.29.

Table 2.3.29 Cost Sharing of a Meter Installation

Category	Detached Houses	Apartments		
		Newly built	Old apartments which are to be rehabilitated by the City Budget	Others
Water Meter Cost	By the customer	By the customer – Included in the apartment's sales price	By the City Budget	By the customer
Installation Cost	By Vodokanal	By the customer – Included in the apartment's sales price	By the City Budget	By Vodokanal

4) Functions of Inspectors (meter reader)

The functions of inspectors are to read meters, to calculate water charges, to record reading result and charges on the Log Book, to collect payments, and to expedite delayed payments. Inspectors visit not only the customers who use the Metered tariff system, but also those who use the Norm tariff system in order to notify the next payment and to expedite the previous ones.

Each inspector is responsible for a particular district, for customers in detached houses and apartments or for customers in the Industry and Communal Services sectors. The inspectors are given incentives according to their performance, i.e. according to their collection rate. Once an inspector is assigned a district, change of the assignment seldom occur except when this is necessary. Thus, an inspector offers all services to the same customers over a long period of time.

Table 2.3.30 Number of Inspectors

	Industry	Communal Services	Detached houses	Apartments
Number of inspectors	26	13	140-145	210
Number of customers per inspector	***240	310	975-1010	*45 **2,077

* Number of apartment buildings

** Number of apartments

*** Number of companies (not number of water meters) per inspector. Some companies have more than one premise and thus several water meters at different locations

The frequency of reading by each customer category is shown in Table 2.3.31.

Table 2.3.31 Frequency of meter reading

	Industry	Communal Services	Detached Houses	Apartments
Reading the water meter	Quarterly	Every 2-3 months (60% of all customers) Every month (for large companies, 40% of all customers)	Monthly in principle (when a customer is absent, reading is done the next month)	
*The number of meter readings per inspector in one day	5.3	7.6	14.4	8.1
**The number of meter readings per inspector in one day	5.4	8.4	45.1	94

* *The present situation*

** *When installation of meters for all customers have been completed*

5) Billing Procedures

i) Ordinary - Procedure

With the current billing procedures for water charges, printed bills are not sent by mail separately, but the Log Book records prepared by inspectors are used for billing and payment/settlement. With regard to the Communal Services and Industry sectors, inspectors do not visit their customers every month. In this case, the customers

themselves fill in the Log Book and deliver them to Vodokanal for settlement. The accuracy of the customer' declaration is confirmed at the next inspector visit.

Customers may pay their water charges for several months, half a year, or once a year in advance as they prefer. Customers who choose to pay in advance are mostly those who are charged based on the Norm tariff system. Approximately 80% of the customers living in detached houses and 50% of those in apartments choose the advance payment. This might be due to the fact that detached house customers are relatively better off than others, enabling them to make advance payments. In terms of privileges of advance payment, discounts for advance payments are not adopted in the current system, but if the tariff is increased during the pre-paid period, customers do not have to pay the increased amount.

ii) Offset Procedure

Among the Communal Service organizations, there might be both accounts receivables and payables to one another. The following scheme is utilized in order to settle the accounts frequently. The entities involved in this scheme might include Vodokanal, Tashteplocentral, Tashteploenergo and other communal service companies. A typical scheme is illustrated in Figure 2.3.19 below. One that has accounts receivable or payables to others can initiate this scheme at anytime and the initiator co-ordinates the entire scheme at such time. The lender of the loans is the Ministry of Finance, Hokimiyat, or the bank where the initiator has an account. The role of the initiator is rotated in a circle because it involves a lot of work and the interest of the loan is charged to the initiator if the scheme is not completed within one day. At least 3 and up to 10-20 parties are involved in the execution of one offset scheme. The amount settled by the offset in Vodokanal is approximately 1/3 of the total payable amount.

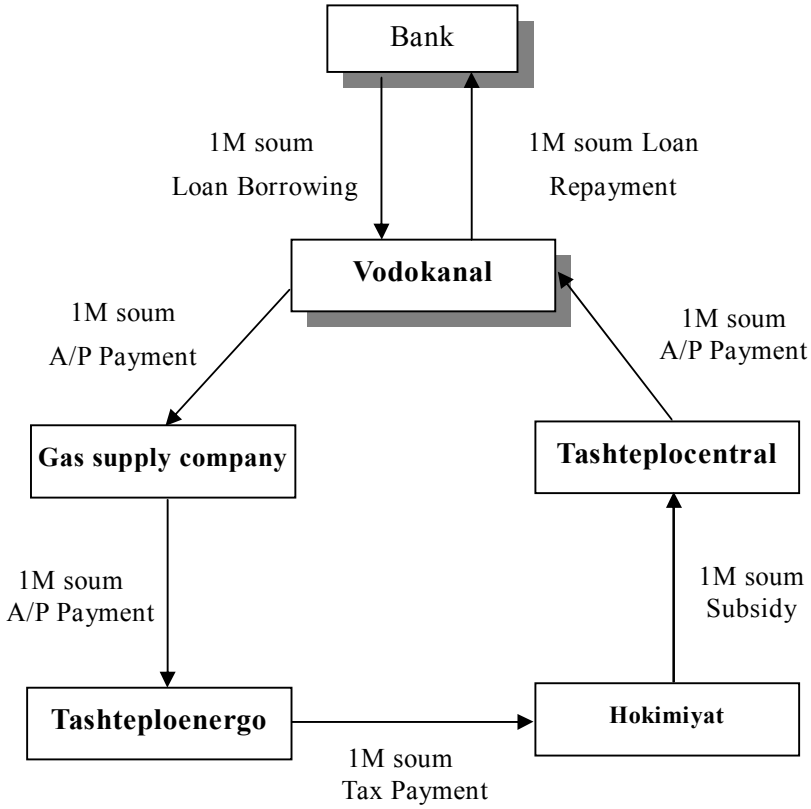


Figure 2.3.19 Typical Offset Scheme

Note1: A/P = accounts payable
Note2: In the above scheme, Vodokanal reduces 1M soum each in both accounts payable and receivable.

6) Payment Collection

i) Collection -Domestic customers

Domestic customers pay their water charges at the counter in banks or post office, or Vodokanal counter, or to the inspectors directly every time the Log is made. After the payments are transferred by banks or the post office, Vodokanal receives the payment documents via the bank or post office. This information is not transmitted electronically but is in a paper form. In Vodokanal, groups in charge of bank/post office data input these data and make summaries every day. As the use of bank accounts is still not common in Uzbekistan, the method of automatic debit transfers from the customers' bank accounts is considered still difficult to introduce under the current conditions.

When the Study was conducted in 2003, 35% of consumers living in apartments paid at banks or post offices, while 65% paid at Vodokanal or to the inspectors. On the other hand, in the case of consumers living in detached houses, the percentages were 3% and 97%, respectively. According to Vodokanal, the percentage of consumers living in detached houses who pay directly to the inspectors is estimated to be in the range of 50% to 70%. Lacking precise data, Vodokanal is not able to clearly differentiate between consumers who pay at Vodokanal's counter or directly to the inspectors. It must also be noted that inspectors can only read the meters when somebody is at home, because meters are installed inside houses as a precaution against theft. This fact is common not only for water meters, but for electricity and gas meters as well.

ii) Collection - Industry and Communal Services

All customers of Ulgurgisuvsavdo and most of the Communal Services Group customers have their own bank accounts. For those who have a bank account, water charges are deducted from their bank account. In this case, Vodokanal or Ulgurgisuvsavdo deliver payment orders to the bank after they receive copies of the Log Books from their inspectors or customers.

In the Communal Service customers' case, after the water charges are deducted by the banks, Vodokanal receives the payment documents from them. This information is not transmitted electronically but is in a paper form. In Vodokanal, groups in charge of bank/post office data input these data and make summaries daily.

In Ulgurgisuvsavdo's case, payment status of each customer is transmitted via a system electronically on daily basis. By utilizing this information, daily status report of revenue, accounts receivable, etc. and its breakdown are produced using a computer program.

iii) Accounting information

Within 5 days of the following month, Vodokanal's Water Sales Section prepares a summary for the previous month's amount and submits it to the Accounting Department. This information includes the amounts billed and amounts received. Payments to Vodokanal by Ulgurgisuvsavdo are made twice a month via a bank and a monthly meetings are held to discuss payment details.

7) Collection Control

Billing and collection status of the Communal Services and Industry customers are controlled mainly in the headquarters of Vodokanal and in Ulgurgisuvsavdo. In the domestic customers' case, however, daily billing and collection status are controlled mainly in each Rayon Vodokanal (Vodkanal branch office). Inspectors for domestic customers also are based in Rayon Vodokanals. Monthly status reports are prepared by Rayon Vodokanals and are sent to the headquarters. This information transfer is not done electronically but in paper forms. In the headquarters, these data are re-input with Foxpro database application. This application then produces a status summary report for overall collection control. The summary report includes customer's basic data, receivable amount, prepaid amount, payment history and etc.

8) Payment Collection Rate

The collection status is recorded by Vodokanal. As shown in Figure 2.3.18, payment may be made in cash at Vodokanal premises or to inspectors, through bank settlement or by offsetting. Offsetting is being done in the Communal Services sector only.

According to the Sales Section of Vodokanal, in 2002, the collection rate (water bills collected versus planned revenue) was 76 percent in total, including that for sewer services. [2] The collection rate for each of the category is 79 percent for domestic customers, 74 percent for communal services and 80 percent for industry in terms of the amount of collection.

[2] Customers were re-allocated between Vodokanal and Ulgurgisuvsavdo during 2003 and thus segregation between the Industry and the Communal Service customers differs from the current segregation.

Under the current system, water charges are collected by Vodokanal or Ulgurgisuvsavdo based on contracts with their customers as summarized in Table 2.3.32. Table 2.3.32 includes related information on such matters as the number of customers, meter reading, collection/contract, payment place/settlement, and period of payment.

Table 2.3.32 Summary of Payment Collection System as of July 2003

Customers category		Number of customers		Meter reading	Collection or contract	Payment place or settlement	Period of payment
Detached Houses	with meter	*45,088	32%	VOD with customers, monthly (inspection)	VOD	Banks, Post offices, VOD direct	monthly or every several months, biannually, annually (advance payment)
	without meter	**96,262	68%	-			
Apartments	with meter	*37,379 (individual)	9%	VOD with customers, monthly (inspection)			
	without meter	**398,804	91%	-			
Communal Services	with meter	Approx. 3,000	73%	VOD, with user, every 2-3 months (60% of all customers) every month (large companies 40% of all customers)		Banks (From customer's account), VOD direct, VOD(offset)	monthly
	without meter	Approx. 1,100	26%	-			
Industry	with meter	***9,082	98%	ULG, with customer, quarterly (inspection)	ULG	Banks (From customer's account)	
	without meter	***185	2%	-			

Note1: VOD is Vodokanal. ULG is Ulgunrgisuvsavdo
* Based on the data provided by a technical department in charge of meter installation
** Based on the data provided by Water Sales Section
*** Number of distribution location, not number of companies, some companies have several premises

2.3.8 Financial Status

(1) Background

The financial evaluation of Tashkent Vodokanal was carried out to analyze the key challenges the company is facing, its financial structure, operational efficiency, and long-term viability, with particular attention to its ability to undertake in the future the LTDP and Priority Projects proposed by this Study.

The present financial assessment is based on the limited information available, as prepared by Vodokanal's accounting staff. It is worth mentioning that the financial analysis is limited due to the fact that some of the details of accounting data are either nonexistent or are in conflict with different sources when compared, the manual accounting systems are inconsistent, and the transition of Vodokanal to the International Accounting Standards (IAS) has not been completed.

Finally, despite the fact that Vodokanal's accounts are periodically verified by authorities, it is made primarily from the point of view of tax compliance and justification of the tariffs, which is controlled in accordance with the antimonopoly legislation adopted in the ROU. However, Vodokanal's financial statements have never been audited by an internationally recognized auditing company. Thus, the financial status of Vodokanal was analyzed based on unaudited statutory financial statements for the year 2002 and for the first six months of 2003 (latest available), as well as a number of supporting accounting data.

The official exchange rates of the local currency, soum, against the USD have changed significantly from 110 as of December 31, 1998 to 687, 970 and 974 soum for 1 USD as of December 31, 2001, December 31, 2002 and June 30, 2003 respectively.

The 1998 figures are provided in this section only for reference, because they have not been adjusted for inflation. The cumulative inflation in Uzbekistan over the past three years is approaching 100%[1)]; therefore, the hyperinflationary environment in Uzbekistan

[1)] According to ADB, CPI growth in Uzbekistan accounted for 24.9%, 27.4%, and 27.6% in 2000, 2001, and 2002 respectively; the figures provided by The Economist Intelligence Unit are close to those of ADB.

always needs to be taken into consideration when analyzing any historical financial data of Vodokanal.

(2) Financial Statements

Vodokanal maintains its records and prepares its statutory financial statements in accordance with Uzbekistan accounting and tax legislation. Abbreviated Statutory Balance Sheets and Income Statements of Vodokanal are provided below.

Table 2.3.33 Income Statements of Vodokanal (unaudited)

(Unit: millions soum)

	2003 (6 months)		2002		1998	
Sales	10,742		21,918		3,429	
Less: VAT	(1,358)		(2,774)		(514)	
Net sales	**9,384**		**19,144**		**2,915**	
Cost of sales	(6,704)		(12,538)		(2,142)	
Gross margin	**2,680**	*29%*	**6,606**	*35%*	**773**	*27%*
Sales, general & administration expenses	(723)		(1,289)		(65)	
Other net operating income (expenses) Note 1	(689)		(2,723)		(289)	
Operating income	**1,268**	*14%*	**2,594**	*14%*	**419**	*14%*
Other net financial income (expenses) Note 2	(6)		(1,971)		0	
Income before tax	**1,262**	*13%*	**623**	*3%*	**419**	*14%*
Taxes	(378)		(622)		(205)	
Net income	**884**	*9%*	**1**	*0%*	**214**	*7%*

Source: Statutory Financial Statements of Vodokanal

Table 2.3.34 Balance Sheets of Vodokanal (unaudited)

(Unit: millions soum)

	June 30, 2003	Dec. 31, 2002	Dec. 31, 1998
Assets			
Fixed assets:			
Acquisition cost	33,561	33,095	4,946
Less: accumulated depreciation	(14,638)	(13,227)	(1,137)
Net book value Note 3	18,923	19,868	3,809
Other long-term assets	628	277	45
Total fixed assets	19,551	20,145	3,854
Current assets:			
Inventories	893	1,016	166
Prepaid expenses	221	147	2
Cash	96	46	127
Debtors Note 4	11,039	8,244	794
Total current assets	12,249	9,453	1,089
Total Assets	31,800	29,598	4,943
Equity & Liabilities			
Equity:			
Charter capital	112	112	99
Reserve capital	23,816	23,499	4,654
Retained earnings	2,063	1,179	0
Total equity	25,991	24,790	4,753
Liabilities:			
Loans Note 5	813	567	0
Suppliers and contractors	1,098	996	107
Settlements with budget	1,706	975	0
Wages & salaries	906	865	45
Social insurance payments	862	1,106	33
Other creditors	424	299	5
Total liabilities	5,809	4,808	190
Total Equity & Liabilities	31,800	29,598	4,943

Source: Statutory Financial Statements of Vodokanal

Notes to the Financial Statements:

1. Other operating income (expenses) is comprised of such items as bonuses and miscellaneous benefits to employees, taxes (excluding the corporate profits tax), fines and penalties, write-offs of bad debts, etc.

2. Other financial income (expenses) in 2002 is comprised of the interest paid (116 mill. soum), negative exchange rate differences on the bank loans denominated in hard currency (516 mill. soum), as well as other net non-recurring revenue and expenses (1,339 mill. soum).
3. Refer to "Fixed Assets and Depreciation" section below for more details.
4. Refer to "Debtors and Cash Collection" section below for more details.
5. Short-term loans from Uzbek Savings Bank taken in order to cover short-term working capital requirements, particularly salaries.

A breakdown of sales of Vodokanal is provided below.

Table 2.3.35 Sales Breakdown for the 6 months of 2003

(Unit: millions m^3, millions soum)

	Water mill.m^3	Sewerage mill.m^3	Water mill. soum (excl. VAT)	Sewerage mill. soum (excl. VAT)	Total mill. soum (excl. VAT)
Industries	22.7	35.6	902	501	1,403
Communal services	130.5	39.5	4,853	544	5,397
Domestic / apartments	75.5	91.1	1,206	729	1,935
Domestic / det. houses	29.9	16.8	481	134	615
Other					*34*
Total	258.6	183.0	7,442	1,908	9,384

Source: Accounting data of Vodokanal

(3) Financial Indicators

Since reliable and comparable financial data are very limited in the water supply sector, especially in the CIS countries, different sources have been used to benchmark the performance of Tashkent Vodokanal. The following key financial indicators were used for analysis:

- Average Tariff for Water and Sewerage (USD/m^3);
- Operating Ratio: Total annual operating costs / Total operating revenues;
- Collection Period: Year-end accounts receivable / Total operating revenues * 12 (Months);
- Current Ratio: Current assets / Current liabilities;

- Quick Ratio: Cash / Current liabilities;
- Labor Costs vs. Operating Costs: Labor costs / Total operating costs (%)
- Debt Service Coverage: Total annual debt service / Total operating revenues (%);
- Return on Equity: Net income / Equity (%);
- Fixed Assets Component Ratio: Fixed assets / Total assets (%).
- Depreciation vs. Water Charges: Depreciation / Total operating revenues (%)

Table 2.2.36 shows a comparison of the key financial indicators for Vodokanal to those of other water supply companies.

Table 2.3.36. Comparison of Key Financial Indicators

Indicators	**Tashkent**[1]	Astana[2]	Phnom Penh[3]	Manila[5]
GDP per capita (USD)	**400**	1,400	300[4]	975
Average tariff (USD/m^3)	**0.03**	0.27	0.24	0.1~0.29
Operating ratio	**0.86**	1.21	0.68	0.79
Collection period (months)	**5.2**	7.0	0.76	2.5
Current ratio	**2.0**	2.9	2.3	2.1
Quick ratio	**0.01**	0.09	n.a.	1.4
Labor costs vs. operating costs (%)	**24%**	30%	25%	20%
Debt service coverage (%)	**0.9%**	0.2%	70%	n/a
Return on equity (%)	**0.00%**	0.27%	2%	20%
Fixed assets component ratio (%)	**68%**	80%	88%	71%
Depreciation vs. water charges (%)	**13%**	14%	38%	13%
Served Population (Thousand)	**2,107**	490	824	4,700

Notes:
[1] Tashkent, 2002. Source: Financial Statements of Vodokanal. Labor costs vs. operating costs (%) was estimated by the Team based on the data provided partially by Vodokanal
[2] Capital City of Kazakhstan, 2002. Source: JICA studies.
[3] 2003 audited financial statements of PPWSA (Phnom Penh Water Supply Authority)
[4] Cambodian Government Statistics Data
[5] Capital of the Philippines. 2002, Manila Water Company Inc website (www.manilawater.com)

The following results can be derived from the comparison of the above indicators. First, the average tariff in Tashkent City of 0.03 USD/m^3 may initially seem to be very low. But even

after considering GDP per capita, the average tariff in Tashkent City is still low when compared to Astana, the capital of neighboring Kazakhstan.

Second, the Quick Ratio, a measure of how quickly a company's assets can be turned into cash, remained at a low level of approximately 0.01 and the company had, in fact, taken short-term bank loans from time to time to solve its liquidity problems. A low Quick Ratio means that the risk of experiencing a cash shortage is very high. This is actually evident as Vodokanal has increased its short-tem borrowing. Also, the current collection period is 5.2 months instead of less than two months, which should be the case, if based on the dates of Vodokanal sales and the dates of payment of customers. The reasons for such a long collection period are explained under "3) Debtors and Cash Collection" below.

Other than the above, there are some points that need to be considered when comparing the financial indicators. The "Fixed asset component ratio" and "Depreciation vs. water charges" are not so high. However, as it will be explained under "4) Costs" below, the cause is the undervaluation of the depreciation costs. When corrected, the above mentioned indicators will increase.

In addition, the debt service coverage ratio is also low, because the current facilities represent the public investments made during the Soviet period, and thus outside loans were not necessary. However, if the current government has no plans to subsidize Vodokanal, then it will have to procure funds from outside. Under such conditions, this indicator will worsen drastically.

(4) Departures from the IAS

The statutory financial statements of Vodokanal could materially differ from the financial statements prepared in compliance with the IAS. The principal departures from the IAS in the case of Vodokanal could be found in the following areas:

1) Hyperinflationary Accounting

The requirements of IAS No. 29, "Financial Reporting in Hyperinflationary Economies",

are not complied with.

2) Valuation and Depreciation of Fixed Assets

The fixed assets were originally valued at historical acquisition costs and subsequently re-valued several times in accordance with the statutory rules. Fixed assets impairment is not assessed in accordance with IAS No. 36, "Impairment of Assets". (See "Fixed Assets" below for more details).

3) Valuation Allowances for Unrecoverable Assets

No allowances are made in the financial statements of Vodokanal for doubtful debts (See "Debtors and Cash Collection" paragraph below). No allowances are made for obsolete and damaged inventories, or for the declining of their net realizable values below the cost.

4) Recognition of Expenses

Accrual basis of accounting could not always be followed in the Statutory Financial Statements; however, estimating the required amount of accrued expenses appears to be impossible without conducting a full-scale audit of Vodokanal.

5) Deferred Taxes

Vodokanal's financial statements do not comply with the provisions of IAS No. 12, "Income Taxes" in so far as deferred taxes are not calculated.

6) Disclosures

Vodokanal's statutory financial statements do not contain all disclosures required by IAS No. 1, "Presentation of Financial Statements", for instance, the disclosure of accounting polices and their changes, segment information, assets details, commitments and contingencies, related party disclosures, subsequent events, etc.

(5) Fixed Assets and Depreciation

The vast majority of the fixed assets of Vodokanal were constructed or acquired when all prices were regulated by the Central Government of the USSR. Moreover, their historical acquisition costs cannot be verified due to the lack of supporting documents. Notwithstanding the above, following the statutory accounting rules, the fixed assets have been revalued (in soum) several times during the recent years using predetermined statutory coefficients. The purpose of these revaluations was to approximate the current cost of the fixed assets. During the revaluation, both the acquisition cost and the accumulated depreciation accounts were multiplied by the same coefficients, with the difference being posted to the reserve capital accounts. Even though these revaluations were not made strictly in accordance with the requirements of IAS No. 29, the revalued costs could represent some approximation of the historical costs adjusted for hyperinflation.

In accordance with the requirements of IAS No. 36, the fixed assets of Vodokanal should have been tested for their potential impairment. The only available approximation of the selling price of the fixed assets is the preliminary evaluation, which was made by the State Property Committee in connection with the prospective privatization of Vodokanal. Since the net selling price of the fixed assets assessed by the State Property Committee is greater than their carrying amount, it appears that no impairment loss for the fixed assets should have been recognized in the IAS financial statements.

It should be pointed out that the acquisition cost of Vodokanal's fixed assets (31,561 million soum or 32 million USD at the current exchange rate) is far below the replacement cost of those assets. Thus, the proposed partial system rehabilitation for Tashkent City was estimated by the previous JICA Study to be about 180 million USD. For comparison, indicative costs for only the first-priority rehabilitation of water supply systems in the cities of Bukhara and Samarkand (about 650 thousand residents in total), financed by the World Bank, exceed 60 million USD. Another benchmarking example is the rehabilitation project for the water supply & sewerage system in Astana, the capital of the neighboring Kazakhstan (about 500 thousand residents), financed by JBIC, where the project cost is

estimated to be approximately 200 million USD. As the result of a significant discrepancy between the carrying amount of the fixed assets and their replacement cost, the depreciation charges of Vodokanal are far from being sufficient for proper rehabilitation of the existing water supply & sewerage systems in Tashkent.

(6) Debtors and Cash Collection

The accounts receivable balance in Vodokanal has continued to grow by approximately 8,000 million soum over the last 1.5 year and has reached 11,039 million soum as of June 30, 2003. This balance represents more than six months of the gross sales revenue, a very high figure. A breakdown of debtors split by major customer group is provided below.

Table 2.3.37 Debtors Breakdown

(Unit: millions soum)

	June 30, 2003	Dec. 31, 2002	Dec. 31, 2001
Trade debtors:			
Industries	1,087	1,066	474
Communal Services	7,811	5,179	1,943
Domestic Customers / Apartments	1,373	1,169	238
Domestic Customers / Detached Houses	129	427	244
Total per management accounts	10,400	7,841	2,899
Other debtors	61	137	346
Difference	*578*	*266*	*(89)*
Total per financial statements	11,039	8,244	3,156

Source: Accounting data of Vodokanal

A list of the biggest debtors and their ageing analysis prepared by Vodokanal are provided below:

Table 2.3.38 Largest Debtors

(Unit: millions soum)

	June 30, 2003	December 31, 2002			
		Total	< 90 days	< 1 year	> 1 year
Industries:					
TAPOiCh aircraft prod. company *)	890	936	161	644	130
GAO TTZ tractor plant	-	91	91	-	-
Communal Services:					
Tashteplocentral	5,994	4,012	1,667	2,305	40
TashTETS	419	137	137	-	-
MPU Tashsuvokavataminot	412	331	73	258	-
Biggest debtors as % of total	*70%*	*67%*	*26%*	*39%*	*2%*

*) TAPOiCh was re-classified by Vodokanal to Communal Services category from July 1, 2003.

Source: Accounting data of Vodokanal

The next table shows the average cash collection per major customer group for the year 2002. On average, 76% of the planned amount was collected in 2002.

Table 2.3.39 Cash Collection

(Unit: millions soum)

Customer Group	Plan 2002	Actual 2002	Percentage
Industries	3,173	2,546	80%
Communal Services	13,373	9,927	74%
Domestic Customers / Apartments	3,725	2,795	75%
Domestic Customers / Detached Houses	1,028	845	82%
Total	21,299	16,113	76%

Source: Accounting data of Vodokanal

The above tables reveal that the debtors' balance includes a significant amount of doubtful debts. Following the local accounting practice, Vodokanal does not write off all such doubtful debts. The biggest customer, whose debt is more than half of the total trade receivables, is Tashteplocentral, the heating & hot water monopoly producer in the City. Tashteplocentral and its sole wholesaler, Tashteploenergo, are currently in a difficult financial situation and their activity heavily depends on subsidies from the City Budget. Therefore, recoverability of the above debts, as well as all other debts depends primarily

on the macroeconomic situation of the country. For instance, the reason why Tashteplocentral has become a bad debtor is because a considerable number of domestic consumers are not able to pay the bills for hot water. Thus, in order to collect debts from this company, the income of domestic consumers needs to increase so that they can pay for hot water, or they will just keep on relying on subsidies from the government. With regard to TAPOiCh, although it is currently producing aircraft parts, it has been experiencing a decrease in new orders. Thus, in order to collect debts from this company, the orders need to go up, if not the company will be forced to sell part of its assets. As can be seen, the collection of bad debts depends significantly on the economic condition of the country, and it can not be solved by the management efforts of Vodokanal alone. Based on the information available and taking also into account the future development uncertainties and the fact that accurateness of the above-provided accounting data can only be verified in a full-scale audit, it could be arbitrary estimated that non-recoverable debts account for at least 30% of the total debtors' balance.

Since direct barter and other non-cash transactions are prohibited in the ROU, Vodokanal is involved in several other types of schemes for off setting its accounts receivable and payable. For this purpose, usually a short-term loan is taken from the bank or a cash tranche is obtained from the Ministry of Finance of the ROU or the Financial Department of Tashkent City. The cash goes through bank accounts of as many as 3 to 20 parties involved and returns back often within one day. In total, about one third of Vodokanal's revenue goes through such schemes for off setting receivables and payables.

(7) Tariff Calculation

Since Vodokanal is a natural monopoly enterprise, its tariffs must be based on "economically justified costs", according to valid legislation. A calculation of such costs is provided below:

Table 2.3.40 Tariff Calculation to Request Tariff Revision

(Unit: millions soum)

	Total	Water supply	Sewerage
Direct production costs:			
Materials	712.31	442.31	270.00
Electricity	3,883.88	3,415.88	468.00
Production salaries	1,824.12	1,161.72	662.40
Social charges	676.45	431.65	244.80
Depreciation	2,629.77	1,758.57	871.20
Capital repair	505.80	405.00	100.80
Current repair	367.25	266.45	100.80
In-house expenses	640.90	532.90	108.00
O&M of water meters	26.65	26.65	0.00
Rent of collector	26.65	26.65	0.00
Transportation	692.04	612.84	79.20
Protection from corrosion	35.57	31.97	3.60
O&M of buildings	46.66	10.66	36.00
Guards	266.45	266.45	0.00
	12,334.50	9,389.70	2,944.80
Period costs:			
Sales costs	534.32	426.32	108.00
General & Administrative costs	660.04	447.64	212.40
Other	1,649.88	1,135.08	514.80
	2,844.24	2,009.04	835.20
Financial costs	266.45	266.45	0.00
Taxes	59.96	59.96	0.00
Total costs	15,505.15	11,725.15	3,780.00
Sales volume (thousands m^3)		532,900	360,000
Budgeted unit costs (soum/m^3)		22.00	10.50

Source: Accounting data of Vodokanal

Domestic customers of Vodokanal currently pay 22.00 soum/m^3 for water and 10.50 soum/m^3 for sewerage services, i.e. approximately 0.03 USD/m^3 for water & sewerage services together. The level of Vodokanal's tariffs as of June 2004 appears to be relatively low when compared to not only those in industrialized countries, but even in Russia (0.28 USD/m^3 in Moscow and 0.33 USD/m^3 is St. Petersburg) and neighboring Kazakhstan (0.27 USD/m^3 in Astana), i.e. about 10 times lower. It should be noted though that the costs are different too.

(8) Costs

A breakdown of costs of Vodokanal is provided below:

Table 2.3.41 Costs Breakdown (2003 vs. 2002)

(Units: millions soum, soum/m^3, millions m^3)

	2003 (6 months)				2002			
	Water supply		Sewerage		Water supply		Sewerage	
	Total (mill. soum)	Per unit (soum/ m^3)	Total (mill. soum)	Per unit (soum/ m^3)	Total (mill. soum)	Per unit (soum/ m^3)	Total (mill. soum)	Per unit (soum/ m^3)
Materials	255	0.98	124	0.68	271	0.51	182	0.44
Electricity	1,615	6.24	356	1.95	2,338	4.42	604	1.46
Prod. salaries	560	2.16	341	1.86	1,108	2.09	609	1.47
Social charges	202	0.78	120	0.66	437	0.83	241	0.58
Capital repairs	68	0.26	12	0.07	404	0.76	114	0.28
Depreciation	772	2.98	545	2.98	1,470	2.78	1,002	2.43
Transportation	212	0.82	101	0.55	428	0.81	210	0.51
In-house expenses	285	1.10	142	0.78	606	1.15	280	0.68
SG&A costs	1,048	4.05	511	2.79	2,817	5.33	1,276	3.09
Other costs	1,277	4.93	100	0.55	4,737	8.95	203	0.49
Total costs	6,294	24.30	2,352	12.85	14,616	27.63	4,721	11.43
Sales volume	*259 mill.m^3*				*183 mill.m^3*			
Total water supply & sewerage costs (mill. soum)	8,646				19,337			
Less: other income and corrections	(146)				(194)			
Total net costs per Income Statement (mill. soum)	8,500				19,143			

Source: Accounting data of Vodokanal

Caution should be used in interpreting the above cost structure of Vodokanal not only because of inflation, which complicates historical comparisons, but also because depreciation charges are not sufficient for proper rehabilitation of facilities, as explained above, and because Vodokanal is likely to cut down on repair and maintenance costs.

It should be pointed out that the acquisition cost of Vodokanal's fixed assets (31,561 million soum or 32 million USD at the current exchange rate) is far below the replacement cost of those assets.

The replacement cost of WTPs and other facilities operated by Vodokanal could be roughly estimated to be about 300 million USD, at least. This amount is equivalent to ten times the booked acquisition cost of the current fixed assets, 32 million USD. If the current acquisition cost of the fixed assets is re-evaluated at the replacement cost, depreciation costs will increase by ten-fold from the current 2.98 soum/m^3 to 29.8 soum/m^3 based on Table 2.3.41. If we consider water tariffs corresponding to depreciation expenses after revaluation of the fixed assets as a reserve of funds for future replacement investments, there is an understatement of 27 soum/m^3 in depreciation expense.

It can be concluded from this that under the currently adopted tariffs revision method, which is based on current costs, it is obvious that current water tariff is understated.

Development of the structure of water supply costs is provided below:

Table 2.3.42 Development of Water Supply Costs Structure

(Units: soum/m^3, percentage)

	2003 (6 months)		2002		2000		1988	
	soum/m^3	%	soum/m^3	%	soum/m^3	%	soum/m^3	%
Materials	0.98	4.1%	0.51	1.9%	0.41	6.6%	0.13	5.1%
Electricity	6.24	25.6%	4.42	16.0%	1.84	29.5%	1.01	39.7%
Prod. salaries	2.16	8.9%	2.09	7.6%	0.44	7.0%	0.22	8.6%
Social charges	0.78	3.2%	0.83	3.0%	0.18	2.9%	0.08	3.3%
Capital repairs	0.26	1.1%	0.76	2.8%	0.43	6.9%	0.08	3.2%
Depreciation	2.98	12.3%	2.78	10.0%	0.51	8.2%	0.22	8.6%
Transportation	0.82	3.4%	0.81	2.9%	0.31	5.0%	0.13	5.1%
In-house expenses	1.10	4.5%	1.15	4.1%	0.27	4.3%	0.08	3.0%
SG&A costs	4.05	16.7%	5.33	19.3%	1.33	21.3%	0.45	18.1%
Other costs	4.93	20.2%	8.95	32.4%	0.52	8.3%	0.13	5.3%
Total costs	24.30	100.0%	27.63	100.0%	6.24	100.0%	2.53	100.0%

Source: Accounting data of Vodokanal

(9) Pension Liabilities and Major Taxes

Obligatory contributions to the Pension Fund must be made by Vodokanal on a monthly basis. They are calculated as 35.0% of the total gross salaries of employees plus 0.7% of

the total sales, in addition to the contributions, which are withheld by Vodokanal at the rate of 2.5% from each employee's salary. The Pension Fund remits the pension payments directly to the pensioners and thus Vodokanal does not have any other pension liabilities, except for the above described monthly contributions to the Pension Fund. In total, the social charges (to the Pension Fund, as well as to the Employment Fund and the Professional Union Fund) are paid in the amount of about 40% of the gross salaries.

VAT is charged at a rate of 20%; however, water supply & sewerage services rendered to domestic customers are exempt from the tax. The VAT payable is determined as a difference between the output VAT accrued on taxable sales and the input VAT for the purchase of goods (works, services) paid in the normal course of business. Corporate profits tax is paid by Vodokanal in 2003 at a rate of 20% (24% in 2002) on the statutory taxable income adjusted for specific items. Other taxes paid by Vodokanal include: (i) ecology tax, calculated as 1% of the production costs; (ii) personal income tax, which is withheld from employees' salaries; (iii) road tax calculated as 1.5% of the sales; as well as a number of less significant taxes.

2.3.9 Management Status

(1) Background

Not only the major facilities of the water supply system in Tashkent City, but also the current status of management has been inherited, to a large extent, from the past. Thus, the management system of Tashkent Vodokanal is still in the process of transformation as the country moves away from the planned economy towards the free market economy and largely depends upon its position as a natural monopoly enterprise and its major role in meeting the basic human needs of the City's population.

(2) Governmental Control

Vodokanal, being a state unitary enterprise owned by Tashkent City *Hokimiyat*, is legally independent and supposedly is a self-sufficient enterprise according to its Charter. Nevertheless, the major decisions relating to development of the water supply system in the City are still heavily centralized. Different governmental authorities exert considerable influence on Vodokanal's business. (Please refer for details to "Relevant Laws and Regulations" section.)

(3) Decision-Making Process

Generally, the "top-down" decision-making process continues to dominate in the water supply system of Tashkent City.

(4) Short-Term Planning

Despite the fact that the Hokimiyat is eventually responsible for the whole water supply system in the City, it is not closely involved into the budgeting process, with the exception of certain aspects, where the *Hokimiyat* exerts its power, such as tariffs, salaries of Vodokanal's employees or capital investments financed from the City Budget. As the result, the short-term planning and budget control is carried out by the management of the company. Annual operating budgets covering Vodokanal's plans for production, revenues and costs for the coming year are prepared by the Economic Forecasting Section of Vodokanal and approved by the General Director. Subsequently, the actual results are compared against the budgeted figures. In certain cases, the budget is adjusted throughout

the year, for instance when the tariffs are changed. Medium or long-term operating budgets are not used by Vodokanal. In accordance with the existing practice, the operating budgets are used only by the management of Vodokanal. Also, the *Hokimiyat* is not required to approve the budget, nor does it control the budget fulfillment on a regular basis.

(5) Long-Term Investment Plans

In addition to the operating budgets, Vodokanal has separate capital investment budgets ("*Titulny Spisok*"). These budgets are drafted annually by the Director on Construction of Vodokanal and approved by the *Hokimiyat* (Department of Economy). Since the capital investments budget for 2004 in the total amount of approximately 1 billion soum is financed primarily from the operating revenues of Vodokanal, only the first priority projects are included based on complaints from the customers and opinions of Vodokanal's staff. The only project that is supposed to be financed by the City in 2004, the Karakamysh sewerage collector, is planned to be completed in early 2004. Vodokanal reports to Hokimiyat on the capital investment budget progress on a quarterly basis. Thus, involvement of the management of Vodokanal in the long-term investment planning in the City's water supply system is limited. It is likely that the main reason for the lack of due attention of the management of Vodokanal to this very important management function is the current difficult financial situation in the water supply business, which does not allow for any significant capital investments to be carried out. At the same time, the *Hokimiyat* does not properly fulfill the long-term investment planning either.

(6) Operating Management

The overall day-to-day management and operation control is executed by the General Director of Vodokanal, who is appointed by the *Hokimiyat*. The General Director delegates a number of his rights and responsibilities to his deputies and heads of respective departments of Vodokanal (see the "Organizational Chart of Vodokanal"). The most critical operating performance issues are discussed at regular management meetings; however, it appears that these management meetings are biased towards the current operating issues, often leaving the strategic planning issues beyond the agenda.

(7) Financial Management

Under the current situation, the ability of the management of Vodokanal to collect overdue water charges from customers is limited in many cases, especially when it relates to other communal services, non-profit organizations, strategically important enterprises, etc. Resolving of such issues is often beyond the ability of Vodokanal's management even though it directly affects the financial position of the company. On the other hand, the existing possibilities for the management to attract funds for financing of major capital investments also seem to be very problematic without back-up of the *Hokimiyat* and the Government of the ROU.

(8) IT Status

The whole management process in Vodokanal is predominantly manual, not computerized and use of new information technologies is still very limited. Moreover, there have not been significant changes in this area since the previous JICA Study, which was completed in March 2000. (Please refer to the previous JICA Study Report for further details on the current status of computerization in Vodokanal and recommendations). According to the latest organization chart, there is no an IT department in Vodokanal as such; however, 3 programmers are employed de facto to support the existing business applications, assist PC operators and also to develop new applications. Repair & maintenance of the hardware is outsourced. No special IT training programs are being run in Vodokanal, except for the on-job training of PC operators upon commencement of their employment. In total, only about 30 client PCs are installed in Vodokanal, which are a mixture of old and relatively new ones, but the vast majority of them are outdated. Only 6 PCs installed in the sales department are connected into a network, with the rest of the PCs being stand-alone. Despite the fact that the majority of the PCs have Windows installed, most of them are running under MS DOS. An obvious shortage of modern PCs, as well as all kinds of peripherals, especially printers, spare parts and consumables can be observed in Vodokanal. Only a few UPS are in operational condition. Communication via Internet and e-mail in Vodokanal is available only for 3 users through a telephone line connection. Backup of users' data is carried out not systematically. The following are the major business applications, which were already reviewed in detail in the previous JICA Study

and are currently used by Vodokanal without any significant changes: (a) "Customers", (b) "Salary Calculation", (c) "Fixed Assets", (d) "Emergency" and (e) "Hydraulic" (use of the last system has been very limited though). All of the above systems are developed in-house, MS DOS-based. In addition, (f) "Leakages Registration" system and (g) "Pump Stations" module have been recently developed. A Legal database and MS Office applications (Word, Excel and Access) are also used by Vodokanal's staff. Finally, it should be mentioned that none of the PCs is used for automation of the production process. Currently, Vodokanal works on installation of PCs in Rayon Vodokanals for entering source data on payment, water meters, etc. These data are supposed to be passed subsequently to the Sales Section of Vodokanal.

(9) Community Participation

It appears that the existing system of management of the water supply business in Tashkent City does not fully imply its eventual accountability to the community. Public opinion is taken of course into account when making water management decisions; however, the general public is not directly involved into the decision-making process, nor even sufficiently informed about Vodokanal's business.

(10) Personnel Management

The existing system of management does not assume wide participation of employees in management of Vodokanal. Moreover, the existing system of employees' remuneration does not ensure proper staff motivation.

(11) Salary System

A salary system common for public officials in Tashkent City is used by Vodokanal. Strictly speaking, a bonus system is also employed, in addition to this system. However, as a result of a survey of the employees of Vodokanal, it appears that almost all of them are not satisfied with the current salary level. On the other hand, a performance-based salary system has been introduced in the subsidiary enterprises for instance in Ulgurgisuvsavdo. Introducing of the performance-based salary system will be considered in order to give employees of Vodokanal incentives for further improvement of their work.

(12) Employee Training

Currently, there are two training systems in Vodokanal. The first one is the joint training in TKEO, which is carried out for Vodokanal's employees together with employees of other communal services such as gas supply, electricity supply, etc. Instructors, who come from universities and institutes, teach not only theories but also techniques and business practice. The training periods depend on each case, which are about 15 days for theories and one month for practices. Another training system is the in-house training on practical techniques in Vodokanal, trained mainly by Directors and Chief Specialists such as the Chief Engineer and his deputies, Chief Technologist and his deputies, Deputy Director on Pipeline Operation, Deputy Director on Sewers, etc. The problems that are common to the both training systems lie in the manually operated technologies, which were introduced during the Soviet times in the 1970's for opening and shutting valves, cleaning in pump stations, etc. Therefore, the technologies in Vodokanal are quite outdated as compared to the modern automatic technologies used in Japan. Additionally, Directors and Deputy Directors in charge of financial matters have no opportunities to learn modern financial theories and practices. Therefore, training systems in Vodokanal should be up-graded through technical assistance from overseas.

(13) Control

A number of internal controls, i.e. control polices and procedures adopted by the management, already exist within Vodokanal; however, some of them appear to be not sufficient (e.g. segregation of duties, verification of the data, etc). The system of internal controls is usually assessed by external auditors during their audit procedures; however, a full-scope external audit of Vodokanal has never been conducted. On the other hand, there has already been established an internal audit function in Vodokanal.

(14) On-Going Changes

The style of management of Vodokanal is being changed rapidly, in line with the on-going reforms in the organization, which are described in the "Organization" section. Even more significant changes are expected in view of the upcoming privatization of Vodokanal (see 2.3.10 "Privatization").

(15) Management Capacity Building

As it follows from the above provided analysis of the present management status, there is an urgent need for updating and improving skills of Vodokanal's staff in modern water supply management systems, planning strategies, financial and commercial management, and investment decisions, in addition to the existing personnel development programs. The capacity of the Hokimiyat and other governmental institutions to monitor and regulate Vodokanal's business without undue interference also needs substantial strengthening.

2.3.10 Privatization

A significant legal base with regard to privatization has been developed in the ROU. Vodokanal, regulated by these decrees, also stands to be privatized. The scheme of privatization has been issued; however, the process has not yet been clarified. The overview of the current privatization process according to the officials of the State Property Committee of the ROU, which is a separate entity that manages both republican and municipal property, is presented in the following section. The word "Privatization" shall refer to this particular scheme throughout this Report.

(1) Overview of Privatization

1) Purposes of privatization

- Improvement of water supply service;
- Cost reduction;
- Water saving because of water shortage;
- Explanation to domestic customers about the current situation of water supply;
- Introduction of new technologies; and
- Foreign investments.

2) Ownership of the new company

The state (*Hokimiyat*) will hold the majority ownership of 51%, 10% will be offered to the employees, and the remaining 39% can be bought by either foreign or domestic companies or private investors. In case that it is an investor, there should be some investment obligations (introduction of new technologies, management style etc.). Basically, an investor can take a one-year control over the new company with investment obligations. If the results are good, that investor can buy shares of the new company and continue its activity. Regarding the share held by the *Hokomiyat*, it could be sold to private investors later based on the results of the privatization process.

3) Decision making at the new company

Basically all companies, if they are converted into stock companies, will be regulated based on the commercial law. All management issues of the new company will be decided during the stockholders' meetings.

4) Commencing of privatization

Vodokanal plans to be financed by EBRD to replace some of its assets; therefore, the privatization process will have to be suspended until the completion of this project. In other words, during the period of a project with any involvement of loans from foreign financial institutions, the privatization process should be delayed.

5) Final decision for privatization

The decisions are made by the State Property Committee and then approved by the Cabinet of Ministers of the ROU. After that, the privatization process can be started with the consent of Vodokanal.

(2) Considering Vodokanal's Privatization Plan

1) Merit of privatization

It is a fact that successful privatization will bring funds from the private sector, which will help lift the burden from the government's shoulders. In addition, although it depends on the proportion in which the private sector will participate, considerable improvements in efficiency can be expected as corporate profit seeking will help implement such measures as cost-cutting, which in turn, will result in strengthening of operational management.

2) Obstacles for privatization

In order to conduct privatization such as the one described above, it is necessary to consider the following points:

i) Participating companies

Under this process of privatization, as 51% of the ownership will remain with the state,

management decisions will be ultimately made by them. Accordingly, profit seeking, as generally understood, that could result from privatization, will be limited, in order to secure public welfare. On the other hand, for the participating companies, this lack of power when it comes to management decisions will increase investment risks. In this case, to make it attractive for the private sector to participate, it is necessary that the expected returns correspond to this high level of risk. For example, a certain level of profits as well as dividends can be expected in the long run, or stockholders can request to be in an advantageous position if they have dealings (e.g. selling equipment) with Vodokanal.

ii) Setting the level of tariffs

The current level of tariffs does not reflect future expenses for replacement of pipes and other fixtures, not to mention requirements for new investments. If these expenses are not covered by the water charges, losses will have to be borne by the privatized company, which will increase the risks of a financial collapse. Thus, it is highly recommended that future fund requirements and other loans and their repayment obligations be considered when setting tariffs. According to the State Property Committee, the process by which tariffs will be established in case of privatization is currently unknown to them, and that this decision falls outside their responsibilities because it's the responsibility of the *Hokimiyat*. If privatization takes place, this issue clearly remains as one that needs to be discussed.

iii) Improving information disclosure and strengthening transparency

In order to promote private sector participation, it is necessary that information is fully disclosed for the investors, and that its high reliability is maintained.

iv) Negotiating with the labor union

Although even after privatization the state will have a majority stake of at least 51% in the company, the legal status as well as internal structure will obviously change with private sector participation. Thus, it is necessary to achieve a consensus with the labor union so that the current status of Vodokanal employees is tenured.

v) Evaluating privatization

There are some well-known water service privatization cases such as that of the UK, which prove that a privatization of public services without losing its public welfare characteristic is possible. However, successful cases such as the one in the UK are very few. Although Vokokanal's process of privatization differs from the above-mentioned example, whatever the case, there are currently no widely recognized methods to evaluate water service privatization.

2.4 Relevant Sector Projects and Studies

2.4.1 On-going Projects of *Hokimiyat*

Hokimiyat has planned or announced the following projects and studies that will be fully considered in this Study:

- Installation of water meters for all domestic customers by the year 2009; and
- Promotion of privatization of Vodokanal.

2.4.2 The Previous JICA Study

From June 1999 to March 2000, the JICA Study "The Improvement of Management and Tariff Policy in Water Supply Services in the Republic of Uzbekistan" (hereinafter referred to as the "Previous Study") was conducted. The objectives of this Previous Study were to formulate and present to the government of Uzbekistan an improvement plan for management as well as a tariff policy for water supply services in Tashkent City and Chirchik City, in line with the requirements of the market economy. Table 2.4.1 indicates main recommendations of the Previous JICA Study on tariffs and management, as well as Vodokanal's respective actions.

Due to the vast fund requirements, significant improvements related to facilities are not yet visible. However, progress has been noted in the digitalization of data as well as in the collection and analysis of data on water demand from domestic customers with water meters.

Table 2.4.1 Recommendation by previous Study Team and Actions taken by Vodokanal

Division	Recommendation	Actions taken by Vodokanal
Tariff	An early transition from the Norm Tariff System to the Metered Tariff System	Vodokanal and TKEO's have made efforts to realize this; however, the target schedule by 2004 failed due to lack of budget
	Meter installation costs should be included in water charges, or a long-term loan system should be introduced for domestic consumers	Vodokanal accepted the former plan and installed meters for a while, however, with the July 2003 tariff revision, the meter cost is no longer included in the water charge. Therefore, a long-term loan from Vodokanal, enabling domestic consumers to purchase a water meter is currently being considered as the recommendation suggests.
	Water meters should be installed outside the houses.	Installation of outdoor water meters in a steel control box was made for 30 detached houses as a pilot project in summer, 2003. Technical as well as financial aspects of this method are currently being examined.
	Excessive cross subsidies between domestic consumers and businesses should be eliminated.	It has almost been eliminated since the tariff revision of March 2000.
Management	Autonomy and decision-making powers of Vodokanal should be increased in order for Vodokanal to become financially independent.	There have been little institutional reforms as yet, in terms of strengthening autonomy and decision-making powers of Vodokanal, organizational changes within Vodokanal are under way within the current institutional framework.
	To achieve financial independence of Vodokanal, water tariffs should be formulated, based on appropriate financial planning including future investment in their facilities. The Study Team indicated the flowchart, which was estimated after three years and also proposed a sample of desirable water tariffs.	Although several water charge increases have been made, the charge only covers operational costs. Thus, the current situation is still far from the desired targets.
	Vodokanal should enhance public awareness of water supply service for domestic consumers.	Some improvements have been made in this regard: a TV series co-sponsored by National Television and a short TV spot ad are being aired.

Table 2.4.1 is explained as follows:

(1) On tariff policy

1) An early transition away from the Norm Tariff System to the Metered Tariff System was recommended in order to increase the effect of water saving and to achieve an ideal state of water supply operations. In this regard, Vodokanal and TKEO's response was that although efforts are being made, problems related to cost burden remained unsolved, causing significant delays from the original target year of 2004;
2) Regarding the purchase and installation of water meters, it was recommended that such costs be included in the water charges, and that even in those cases where customers

should bear these costs, long-term loans would be offered. These measures would have made widely and easily. However, with the July 2003 tariffs revision, the inclusion of such costs in the water charges was ruled out, forcing users to bear the costs themselves. It is worth noting that long-term loans (e.g. 4 years) are currently being considered as an alternative payment method;

3) The recommendation on water meters was that changes were necessary in terms of the place for installation (indoors) and the method for installing them. In this regard, a pilot project was designed at Vodokanal and is currently being implemented. The project consists of installing water meters outdoors for detached houses;
4) In terms of the water charges collection method, a computer aided water charges collection system was recommended in the Previous Study. Although problems on procurement of funds to purchase computers still remain, some improvements can be seen;
5) In terms of handling of overdue receivables from the state-controlled enterprises, the Previous Study pointed out that planning could not be made due to both long-term overdue receivables from some of them (TAPOiCH and the Heating company) and the offsetting of receivables against payables between state-owned enterprises. Since the issue on overdue receivables depends on the overall economic situation of the country, a real solution has not been reached. On the issue of the untimely offsetting of receivables against payables, a minor improvement can be seen as current efforts towards short-term settlement of accounts are being made;
6) Although the introduction of a Two-Part Tariff System was recommended as a way to secure future funds for new capital expenditures, it has not been adopted yet; and
7) As for the excessive cross-subsidies that existed between domestic customers and industries (which reached the approximate maximum of 6-fold), these have been almost eliminated since the tariff revision in March 2000.

(2) On Management

1) The Previous Study pointed out that, in order for Vodokanal to become financially independent, it was imperative to increase its autonomy by shifting decision-making authority regarding future plans on water supply operations, organizational reforms, as

well as financial improvements. In this regard, although there have been no institutional reforms, organizational changes are under way within the current institutional framework;

2) Vodokanal's need to set aside its own funds for future investments was also pointed out as an important condition to become financially independent. However, although several water tariff increases have been made, almost all revenues of Vodokanal are currently allocated to cover operational costs. Thus the current situation is still far from what was recommended in the Previous Study;
3) The introduction of International Accounting Standards (IAS) as well as information disclosure and external auditing were recommended in order to enhance accountability, which is a necessary condition for Vodokanal to seek external funds. Currently, the possibility of Vodokanal staff to attend a seminar on IAS organized by TACIS is being considered. However, the IAS and external auditing have not been implemented yet;
4) In order to increase water saving awareness and to improve water service operations, the importance of enhancing public relation activities towards domestic customers was emphasized. Some improvements have been made in this regard: a TV series co-sponsored with the National Television has already been broadcasted and a short TV spot is being created; and
5) Promoting the further use of computers for collection of water charges and administrative operations in general was stressed. However, due to the budgetary constraints, no progress has been made on this issue with the exception of water charges collection.

(3) On Facilities

Due to their vast funds requirements, significant improvements related to facilities could not be seen. However, there is some progress on the digitalization of data as well as on the collection and analysis of water demand data from domestic customers with water meters.

1) One of the causes for water losses is the indoor leakage in apartment buildings. Thus the need for enhanced repair and maintenance in this type of household was strongly recommended. However, due to the problems related to cost burden, a large-scale

project has not yet been implemented;

2) The need to value and assess the current status of all water facilities was pointed out as a precondition for the replacement and renewal of deteriorated facilities, as well as to build a new system that would meet the requirements of the future water demand. In reference to this issue, assessments of some sections of the pipeline were conducted; however, an overall evaluation has not been made; and
3) Although the formulation of a new capital expenditure plan for power and energy saving as well as for the stabilization of operations was recommended, with the exception of the suggestions made in the Previous Study and the emergency investment plans that will be conducted with the EBRD loan, no specific capital expenditure plans have been drafted.

2.4.3 EBRD Project

The most relevant project is the Tashkent Water Supply Improvement Program of EBRD (the EBRD Project). The purpose of the EBRD project is to invest on the facilities in Tashkent city water supply services which require urgent rehabilitation and improvement. The total project cost is estimated at 14.5 million USD, of which up to 10.0 million USD is supposed to be financed by EBRD, and the rest by ROU. However, since the latter part comprises mostly civil engineering work, it is planned that an affiliated company of Vodokanal will do the job. The borrower will be the Tashkent city *Hokimiyat*, who will re-lend the loan to Vodokanal.

As of February 2005, the loan agreement had been signed between EBRD and the *Hokiymia* under the following conditions: a repayment period of 15 years with a three-year grace period, with an interest rate of LIBOR (London Interbank Offered Rate) plus 1% (fund procurements are estimated at 3.5% of interests rate with 15 years repayment and a three year grace period). The contents of the project are implementing the items as indicated in Table 2.4.2. The target year of completion is 2008. The EBRD project is supposed to contribute to stable supply of water by improving and rehabilitating the facilities which need urgent action. The main items of the EBRD project are: partial improvements through urgent replacement of deteriorated facilities at Kadirya, Boz-su and Kibray WTPs; partial improvement of the PS and

construction of a new PS for low-pressure level areas.

Table 2.4.2 Contents of the EBRD Project

Place	Items	Contents
Kadirya WTP	Replacement of No.1 and No.2 Intake PS	15 units of pumps with valves, transformers and control panels
	Filter improvement/ replacement	Replacement of 50% of valves, introduction of automatic filter washing
	Laboratory equipment	Replacement of all equipment
Boz-su WTP	Replacement of intake and distribution PS	Pumps with valves, transformers and control panels
	Replacement of filters	New construction of rapid filters with capacity of 100,000 m^3/d
Kibray WTP	Replacement of well pump	63 units of pumps
Lisunova PS	New construction	Capacity of 1,000m^3/hr
Oktyabrskiy Pipe	Purchase and setting up of equipment; overflow-pipe construction	Reinforcement of pipes D1000 and D1200 Total length=2km

2.4.4 Others

(1)World Bank

The "Bukhara and Samarkand Water Supply Project" of the World Bank is currently at an early stage of its implementation. According to the signed documents, the World Bank will allocate 40 million USD to this project, which aims to help improve the water supply services in Bukhara and Samarkand, two of Uzbekistan's largest and most historic cities. The project, with an estimated total cost of about 62 million USD, consists of the following components:

- Strategic rehabilitation and efficiency improvements of existing facilities;
- Institutional strengthening of the two cities' water utility agencies through a management contract with an international water utility operator; and
- Strengthening of finances through improved financial management and commercial practices.

(2)ADB

The "Urban Water Supply Project" was started by ADB in three provincial cities of Karshi, Djizzak and Gulistan, in the central and southern parts of the country, in 2003. The loan amount is 36.0 million USD and the estimated total project cost is 65.6 million USD. The

project consists of two components: (i) water supply, which includes rehabilitation and upgrading of the water supply systems, and (ii) capacity building.

Another relevant project of ADB is the "Western Uzbekistan Rural Water Supply Project", which is supposed to improve the situation with potable water supply in the autonomous Republic of Karakalpakstan and the province of Khorezm. Currently this project is in its early stage of implementation.