3 CHAPTER 8 REHABILITATION AND EXPANSION PLAN OF THE VAKHSH CONDUITS

Appendix Rehabilitation and Expansion Plan of the Vakhsh Conduits

（1） Attached Tables

（2） Attached Figures

3 CHAPTER 8 REHABILITATION AND EXPANSION PLAN OF THE VAKHSH CONDUITS

Appendix Rehabilitation and Expansion Plan of the Vakhsh Conduits

3. CHAPTER 8 REHABILITATION AND EXPANSION PLAN OF THE VAKHSH CONDUITS

8.1 REHABILITATION AND EXPANSION PLAN

8.1.1 TARGET FACILITIES OF THE PLAN

The Scope of the Study on the Plan is limited in the Rayons of Vakhsh, Dzhilikul and Kumsangir except Rayon Centers. The Study Team accordingly established the rehabilitation plan for the following systems:

- The Vakhsh Conduits from the Sarband Intake to Vakhsh, and Dzhilikul, Dusti, and Kolkhozobod via Uzun (refer to the *Figure 8.1.2*) and the sub-mains which connect the main and the WSSs
- The WSSs located in the area in Bokhtar Rayon shall be excluded
- The WSSs owned by the Vodokanal
- The WSSs located in the area where the main conveyance pipe is owned by the Vodokanal of Kolkhozobod (downstream area from the valve which locates around 2.2km before Kolkhozobod) shall be excluded
- The area where CIP is installed in Vakhsh Rayon shall be excluded except section between the connection point of the CIP with the Steel Pipe of Vakhsh Conduits and the Mehnatobod village WSS[1]. Because, the brittle CIP of which the age is reportedly over 30 is to be replaced and no WSS connects with the Conduits in this area. Furthermore, the Conduits in this area have not reached the Vakhsh Rayon center yet. A WSS in the Vakhsh Rayon center pumps up water from the Stalin canal. The intake locates at the downstream point of the Sarband SB (Intake).

After all, the number of WSSs to be studied for rehabilitation is 53 and is shown in the unshaded cells of *Table 3.3.1 (Chapter 3)*.

Regarding the WSSs of which water source is a well or an irrigation canal, it is recommended establishing independent WSS with a treatment plant considering the cost efficiency.

8.1.2 PROPOSED PROJECT TIMELINE

Table 8.1.1 presents the proposed Project Timeline which is the base of the financial analysis including population projection and water demand prediction. As shown in the table, the Project duration of the Project's financial situation is considered 20 years starting from 2009 until 2028. If the Project duration is long, there will be the risk that the capacity of facilities will be excessive due to the uncertainty of the prediction and if the Project period is short, the next phase rehabilitation will not be able to be planned and designed based on the actual water supply data, and, moreover, if the actual water demand exceeds the projected one, there will not be sufficient time and maybe budget to prepare further expansion work.

[1] A drain facilities should be installed just after the connection point of Mehnatobod village WSS to evacuate water of the Vakhsh Conduits into nearby canal.

Table 8.1.1 Proposed Project Timeline

year	event
2007	Starting the JICA Study
2008	Rehabilitation Planning
2009	Completion of the JICA Study, Starting the detailed survey and planning, Financing
2010	Detailed planning and design, Financing
2011	Detailed design and construction works
2012	Detailed design and construction works
2013	Partial Inauguration of the Systems, Detailed design and construction works
.....	OM&M, Detailed survey and design, and construction works
2028	Final year of the Project duration of the Rehabilitation Project of the Vakhsh Conduits System

Source: own study

8.1.3 WATER DEMAND PREDICTION

(1) Factors to be Applied to the Water Demand Prediction

The following factors are necessary for the water demand projection:

1) Per capita consumption per day

Considering the existence of a developed irrigation canal system, the rural water supply system should be more convenient in terms of fetching water. The Study Team accordingly recommends designing the WSS based on a yard connection in order to assure the sustainability of the water supply. If a consumer wants to have a yard connection, it should be installed at a cost of service facilities such as service pipe (from just after a stop valve to a yard tap via a water meter), water meter and other fixtures should be borne by it.

It will make the service facilities consumer's property and consumers should consequently maintain it, the consumer shall bear the cost of maintenance. Furthermore, a metered rate system can be applied and it will reduce the UFW i.e. foster the sense of water saving. A progressive rate system can be developed which can consider people who are in a financially difficult condition and to recover the renewal cost of the WSS.

The rehabilitation project should be based on collective water supply including yard connections on a request basis and the project should aim to achieve the rate of yard connection at nearly 100% by the end of the Project duration, 2028.

Considering the above, the Study Team proposes that the per capita consumption per day in the final year of the project duration as 50 liters referring to the literature of WHO, and other organizations. That of 2013, which is the first year of starting the operation of the WSSs and Vakhsh Conduits after the rehabilitation and communal taps seems to prevail, and is set as 20 liters due to the relatively short distance between a house and a communal tap, i.e. the time for fetching water is not long.

As for the Rayon Centers, considering the water supply of Vodokanal for the several stories apartment house which has two (2) or three (3) taps and rather rapid urban development, 100 liters/capita/day in the final year of the project duration and 50 liters/capita/day in 2013 have been projected.

2) Coverage

Though the definition of "the water supply coverage" in Tajikistan is not clear, the National Development Strategy (NDS) of the Tajikistan Government approved in 2007 sets the targets of the water supply coverage as shown in *Table 8.1.2*. The national water supply program promulgated in 2006 reportedly shows the urban water supply coverage in 2006 as 87% and targets the rural water supply coverage in 2020 for 90%.

Table 8.1.2 Targeted Water Supply Coverage in NDS

	2004	2010	2015
Rural Water Supply	47	64	74
Urban Water Supply	93	96	97

Source: own study

As mentioned above, the Study Team assumed the water supply coverage to be applied to the water demand prediction from 2004 to 2028 in the following *Table 8.1.3*.

Table 8.1.3 Water Supply Coverage applied to the Study

	2004	2006	2010	2015	2020	2028
Rural Water Supply	47	52	64	74	90	90
Urban Water Supply		87	96	97	97	97

Source: own study

The water supply coverage in the years shown in the Table, assume an increase incrementally in equal intervals up to 90% in case of the rural water supply and 97% in case of the urban water supply in 2020 and both rural and urban coverage will not change from 2020 to 2028 considering the difficulty to achieve 100% water supply coverage in a number of countries.

3) Rate of unaccounted-for water (UFW)

According to the NDS, the loss in drinking water supply system is 50 to 60% on average. 50% is accordingly applied to the rate of UFW in 2013 and UFW of 30% in the final year considering the contribution of the rehabilitation during the project duration. The rate from 2014 to 2027 is assumed to decrease incrementally by equal intervals up to 30% in 2028.

4) Water demands of factories, businesses, public institutions and WSS's use as percentage of a domestic water demand

Since, data and literature concerning the water demand of factories, businesses and public institutions for water supply systems in rural towns and villages is scarce, the Study Team referred to the Second Water Utilities Book (Asian Development Bank, 1996) which shows such data of relatively large urban water supply systems. According to this literature, the lowest industrial, commercial, and public institutional water use among 23 WSSs as a percentage of the domestic water demand is 4% respectively. Considering that data is rather old, 5% of domestic use is assumed as water demands of factories, businesses, and public institutions to the water supply in the Rayon Center and 2% for the rural water supply, taking into account micro-businesses will be set up according to the development of rural areas.

(2) Population Projection

The population projection of six (6) Rayons and Kurgan Tyube is made using statistics shown in *Table 3.2.1* and *Table 3.2.2* in order to estimate the water demand for the Vakhsh Conduits system.

1) Methodology for Population Projection

In case the data of several years are available as shown in *Table 3.2.1*, the following three methods are used to estimate the future population, and one method which gives the result between the largest and the smallest ones. Because socio-economic factors such as investment plans, development trends of industries, etc. which influence population growth are not available.

If only a datum is given as shown in *Table 3.2.2*, the projection by geometric series is applied referring to the estimation result of the related Rayon shown in the *Table 3.2.1*.

Concerning the population in the service area of WSSs connected to the Vakhsh Conduits, it is assumed that the ratio between the populations in the service area to that of Rayon is constant during the project duration.

i) projection by arithmetic series

$P=P_0(1+a \cdot n)$

where P : Population
P_0 : Population in reference year
a : Coefficient relative to population growth
n : Number of years from the reference year

ii) projection by geometric series

$P=P_0(1+r)^n$

where P : Population
P_0 : Population in reference year
r : Population growth rate
n : Number of years from the reference year

iii) projection by power function

$P=P_0+An^a$

where P : Population
P_0 : Population in reference year
A, a : Constants
n : Number of years from the reference year

2) Population Projection of six (6) Rayons and Kurgan Tyube

The method of projection by arithmetic series is applied to Sarband Rayon and Kurgan Tyube, and the population project of other Rayons are made by the method of projection by power function. The results are shown in *Attached Tables 8.1-8.7* and the following *Table 8.1.4* presents the projected population in 2013 and 2028 of six (6) Rayons and Kurgan Tyube.

Table 8.1.4 Projected Population of Rayons and Kurgan Tyube in 2013 and 2028

	Population in 2013	Population in 2028
Sarband	29,100	41,100
Bokhtar	243,500	337,300
Vakhsh	166,400	217,600
Kolkhozobod	175,800	237,800
Dzhilikul	103,100	139,000
Kumsangir	117,100	157,400
Kurgan Tyube	79,800	100,800
Total	914,800	1,231,000

Source: own study

3) Projection of Rayon Centers Population and Rural Population

Since the population in 2007 is the only available data of each Rayon Center, the population projection is made in the following manner:

i) Population growth rate is computed based on the result of each Rayon mentioned above.

ii) Add 0.5% to the population growth rate considering more rapid population growth than that of the rural area due to expected socio-economic growth. This assumption means some population will flow into the Rayon Centers from the rural areas.

iii) The population of each year in the project duration is made applying the method of projecting by geometric series.

The rural population is calculated by subtracting the population of Rayon Center from that of the whole Rayon.

The results of the projection are shown in *Attached Tables 8.1-8.7* and the following *Table 8.1.5* shows the Population of Rayon Centers and Rural Population in 2013 and 2028.

Table 8.1.5 Projected Population of Rayon Centers and Rural Areas in 2013 and 2028

	Population in 2013		Population in 2028	
	Rayon Center	Rural Area	Rayon Center	Rural Area
Sarband	16,700	12,400	27,000	14,100
Bokhtar	8,800	234,700	13,400	323,900
Vakhsh	14,300	152,100	20,500	197,100
Kolkozabad	15,300	160,500	22,800	215,000
Dzhilikul	16,200	86,900	24,200	114,800
Kumsangir	15,300	101,800	22,700	134,700
Total	86,600	748,400	130,600	999,600

Source: own study

(3) Water Demand Prediction

1) Average Daily Water Demand

The Study Team made the water demand prediction based on the Population Projection applying the factors described in *Section 8.1.3 (1)* for all the Vakhsh Conduits System as well as the target part of Conduits, i.e. from the Sarband SB to Vakhsh, and Dzhilikul , Kolkhozobod and Dusti via Uzun.

Following *Table 8.1.6* shows the water demand prediction of the rural area in six (6) Rayons for reference in the final year of the project duration.

Table 8.1.6 Water Demand Projection in Rural Area of six (6) Rayons

			year	2028
(1)	rural water supply coverage	%		90
(2)	Assumed rate of UFW	%		30
(3)	rural population			999,600
(4)	rural population will be served		(3)x(1)/100	899,600
(5)	liter per capita per day	liter		50
(6)	domestic use	m^3/day	(4)x(5)/1000	44,980
(7)	industrial use (2% of domestic use)	m^3/day	(6)x0.02	900
(8)	commercial use (2% of domestic use)	m^3/day	(6)x0.02	900
(9)	Institutional use (2% of domestic use)	m^3/day	(6)x0.02	900
(10)	sub-total	m^3/day	(6)+(7)+(8)+(9)	47,680
(11)	UFW	m^3/day	(10)x((2)/(1-(2)/100)/100	20,434
(12)	sub-total	m^3/day	(10)+(11)	68,114
(13)	water use of WSS (5% of above)	m^3/day	(12)x0.05	3,406
(14)	average daily water demand in rural	m^3/day	(12)+(13)	71,520

Projected Water Demand of Sarband, Bokhtar, Vakhsh, Kolkhozobod, Dzhilikul and Kumsangir Rayons and Kurgan Tyube

Projected water demand in 2013 and 2028 of the Sarband, Bokhtar, Vakhsh, Kolkhozobod, Dzhilikul and Kumsangir Rayons and Kurgan Tyube are 595,00 m^3/day and 123,900 m^3/day respectively. Details are shown in the *Attached Table 8.8* (Supporting Report).

Projected Water Demand on the Vakhsh Conduits from Sarband Settling Basin to Vakhsh, and Dzhilikul , Kolkhozobod, and Dusti via Uzun

As aforementioned, the Study covers captioned Vakhsh Conduits. The projection of water demand on the Conduits is necessary to prepare their rehabilitation plans. Having the water demand, following water demand is to be subtracted from the total projected water demand mentioned in Section 8.1.3 (1).

- Water demand of Kurgan Tyube and Sarband Rayon because they are out of the study scope
- Water demand of the Vakhsh Rayon Center. The WSS in this area reportedly takes water from a downstream point of the Stalin canal. Considering the necessity of water treatment, it is recommended constructing independent WSS by selecting an appropriate place for gravity intake in the Starling canal. Extension of 3.5km around the 600mm diameter conduit does not seem to be economical because the diameter of the conveyance pipe for Vakhsh Rayon Center will be apparently smaller than 600mm.
- 60% of the projected water demand of the rural area of Vakhsh Rayon is to be subtracted from the total projected water demand. Other rural WSSs in the Vakhsh rayon of which the water source is a canal are also recommended constructing an independent WSS though some of them can be constructed by a centralized water treatment plant. According to the result of the inventory survey implemented by the JICA Study Team, Nine (9) WSSs out of 15 (60%) have an intake at the irrigation canal. It is assumed that this rate will not change until the final year of the project duration.

– Projected water demand of following WSSs

Table 8.1.7 WSSs and their service population excluded from the Water Demand Projection on the target Conduits

WSS	Jamoat	Rayon	Water Source	Population
Kirov village from the bore hole 5 to Main pipe line	Tugalang	Kolkhozobod	well	5,000
Yosh-Lrninchi (From bore hole 4 to main pipe-line)	Tugalang	Kolkhozobod	well	5,000
Water constructions Uzun 1	Uzun	Kolkhozobod	well	3,986
Pyatiletka of Jamoat Tugalang	Tugalang	Kolkhozobod	irrigation canal	2,791
5-th village	Pyanj	Kumsangir	irrigation canal	6,600
total				23,377

Since these WSSs might have their water source nearby and the conveyance, it seems to be economical to operate as independent system rather than the WSS having water from the Vakhsh Conduits.

Following *Table 8.1.8* shows the projected water demand in 2028 on the Vakhsh Conduits covered by the JICA Study. *Attached Tables 8.9-8.12* (Supporting Report) presents the detail of water demand projection for the *Table 8.1.8*.

Table 8.1.8 Water Demand on the Vakhsh Conduits covered by the JICA Study

	Area		Water demand (m^3/day)
(1)	Total		123,892
(2)	Kurgan Tyube		30,514
(3)	Sarband		5,530
(4)	Vakhsh Rayon Center		3,435
(5)	60% of Vakhsh Rural		8,461
(6)	four (4) WSSs in Kolkhozobod and one (1) WSS in Kumsangir		2,489
	Average Daily Water Demand on the Vakhsh Conduits	(1)-(2)-(3)-(4)-(5)-(6)	73,463

Table 8.1.9 shows the yearly projected water demand from 2013 to 2028 on the Vakhsh Conduits covered by the JICA Study.

Table 8.1.9 Projected Water Demand on the Vakhsh Conduit

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
assumed rate of UFW	%	50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
Total Water Demand of Six (6) Rayons and Kurgan Tyube	m^3/day	**59,476**	**63,378**	**67,456**	**72,037**	**76,784**	**81,822**	**86,981**	**92,875**	**96,758**	**100,575**	**104,433**	**108,302**	**112,174**	**116,077**	**119,970**	**123,892**
Kurgan Tyube	m^3/day	26,006	26,326	26,555	26,878	27,164	27,441	27,767	28,064	28,352	28,651	28,982	29,239	29,576	29,915	30,175	30,514
Sarband Rayon	m^3/day	2,343	2,532	2,741	2,927	3,129	3,373	3,587	3,808	4,042	4,225	4,425	4,673	4,880	5,070	5,317	5,530
Vakhsh Rayon Center	m^3/day	1,680	1,785	1,909	2,001	2,104	2,224	2,332	2,438	2,576	2,694	2,800	2,921	3,045	3,169	3,307	3,435
Vakhsh Rural	m^3/day	4,744	5,321	5,920	6,637	7,380	8,155	8,974	9,930	10,450	10,975	11,513	12,024	12,548	13,069	13,587	14,102
60% of Vakhsh Rural	m^3/day	2,846	3,193	3,552	3,982	4,428	4,893	5,385	5,958	6,270	6,585	6,908	7,214	7,529	7,841	8,152	8,461
four (4) WSSs in Kolkhozabad and one (1) WSS in Kumsangir	m^3/day	806	911	1,013	1,147	1,274	1,407	1,554	1,723	1,815	1,924	2,012	2,117	2,211	2,297	2,403	2,489
Average Daily Water Demand on the Vakhsh Conduits	m^3/day	**25,795**	**28,631**	**31,686**	**35,102**	**38,686**	**42,483**	**46,357**	**50,884**	**53,703**	**56,496**	**59,307**	**62,138**	**64,933**	**67,785**	**70,616**	**73,463**
Vakhsh Conduits to be loaded (based on the maximum daily water supply)	m^3/day	35,596	39,511	43,727	48,441	53,386	58,627	63,973	70,220	74,110	77,964	81,843	85,751	89,607	93,544	97,450	101,378
Population corresponded to		423,621	446,388	469,948	500,526	532,448	565,185	598,609	640,377	653,938	667,723	681,607	695,428	709,363	723,592	737,499	751,908
Maximum daily water demand by 83 WSSs	m^3/day	21,427	23,297	24,915	26,803	28,736	30,295	32,236	34,153	35,735	37,706	39,726	41,232	43,264	45,347	46,869	48,959
Population corresponded to		256,050	261,961	268,034	274,049	280,272	286,456	292,695	298,820	305,106	311,633	318,169	324,508	331,064	337,810	344,256	348,790
Assumed maximun daily water demand on the Conduits	**m^3/day**	**21,427**	**26,757**	**32,087**	**37,417**	**42,747**	**48,077**	**53,408**	**58,738**	**64,068**	**69,398**	**74,728**	**80,058**	**85,388**	**90,718**	**96,048**	**101,378**

2) Maximum Daily Water Demand

The water demand varies seasonally, it is big in summer and small in winter. The peak factor for daily water demand acquired by following formula shown in "3.4 (2) Establishment of Quantitative Service Level Indicator" represents the scale of this variation. (Though water supply and water demand is different, if "water demand" replaces "water supply" in the formula, it can be considered that the return will be same.)

$$\text{the peak factor for daily water demand} = \frac{\text{the maximum daily water supply (usually in summer)}}{\text{the average daily water supply (yearly water supply/365)}}$$

The capacity of the Vakhsh Conduits should be sufficient to deliver the MDWD.

Namely, the Vakhsh Conduits shall have the capacity over the total of MDWD of the WSSs covered by the Conduits.

The Study Team established the rehabilitation plan through the hydraulic model applying the MDWD to the Vakhsh Conduits acquired by following manner:

- summing up the average daily water demand of the 83WSSs covered by the Vakhsh Conduits
- summing up the MDWD of said 83WSSs
- calculation of the peak factor to be applied to the Conduits
- having the MDWD on the Vakhsh Conduits

Concerning the MDWD and the peak factor of the WSSs, the value of them depend on the scale of service area, climate, etc. Usually, the data of actual water demand in the past several years or the values applied to the WSS under the similar conditions, however, no data is available for the WSSs covered by the Conduits.

The Study Team consequently borrows the data on the peak factor from the following *Figure 8.1.1*.

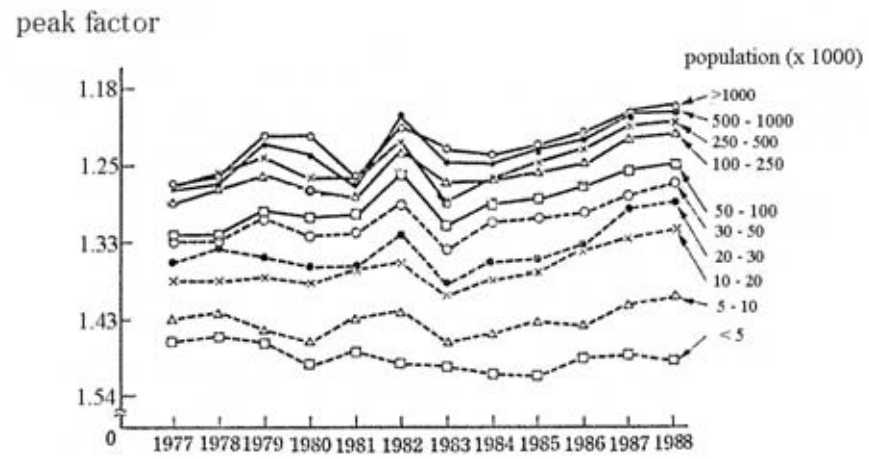

Figure 8.1.1 Peak Factor for Daily Water Demand

Source: Japan Water Works Association, 1990, Design Criteria for Waterworks Facilities

Following table shows the peak factor for daily water demand applied to the WSSs:

Table 8.1.10 Peak Factor for Daily Water Demand Applied

Service Population	Peak Factor
1 – 5,000	1.45
5,001 – 10,000	1.34
10,001 – 20,000	1.27

Source: own study

The peak factor to be applied to the Vakhsh Conduits is got as following:

- total of the average daily water demand of the 83 WSSs: 35,400 m^3/day
- total of the MDWD of the 83 WSSs: 48,960m^3/day
- the peak factor for the daily water demand = 48,960/35,400 = 1.38

The MDWD on the Vakhsh Conduits by applying this peak factor is:
73,463m^3/day (predicted average daily water demand in 2028, refer to *Table 8.1.9*) x 1.38 = 101,378 m^3/day

3) The Maximum Daily Water Demand of each year in the Project duration

As mentioned above, there are 83 WSSs connect with the Vakhsh Conduits among which 27 is under shutdown and 15 can not distribute water to meet the demand. The repair and restoration of these WSSs are urgent matters and it should be kept abreast with the Plan.

On the other hand, there is the difference between the average daily water demand on the Vakhsh Conduits; 73,500m^3/day and that of 83 WSSs; 35,400m^3/day. The difference; 38,100m^3/day is the water demand of the areas where WSSs do not exist. It is assumed that the WSSs will be constructed keeping pace with the progress of the Plan.

Considering above mentioned fact, the Study Team applied the following assumption to the plan:

- The MDWD on the Vakhsh Conduits in 2013, the first year of project duration: the MDWD of 83 WSSs; 21,400m^3/day.
- The MDWD on the Vakhsh Conduits in 2028, the final year of project duration: the MDWD on the Vakhsh Conduits based on the projected service population; 101,400m^3/day.

Table 8.1.9 shows the projected MDWD on the Vakhsh Conduits of each year in the project period.

8.1.4 REHABILITATION PLAN

Figure 8.1.2 shows the rough outline of hydraulic model of the Vakhsh Conduits. The name of each zone is frequently referred in the following text and attached tables.

(1) Projected Intake

As explained in “3.3 Current Conditions of the Vakhsh Conduits”, there are two pipeline routs in the Vakhsh Conduits, one is for Kurgan Tyube with double pipelines and another is single but dendritic pipeline for Bokhtar, Vakhsh, and Dzhilikul, Kolkhozobod, Kumsangir via Uzun.

The water supply to the areas mentioned above complying with the national plan will necessitate around 140,200m^3/day. The breakdown of it is as follow:

- for Kurgun Tyube: 38,800m^3/day
  the average daily water demand in 2028: 30,514m^3/day
  the peak factor for the daily demand: 1.27 (shown in *Table 8.1.10*)
  the MDWD in 2028: 30,514 x 1.27 = 38,800 m^3/day
- for five (5) Rayons: 101,400m^3/day

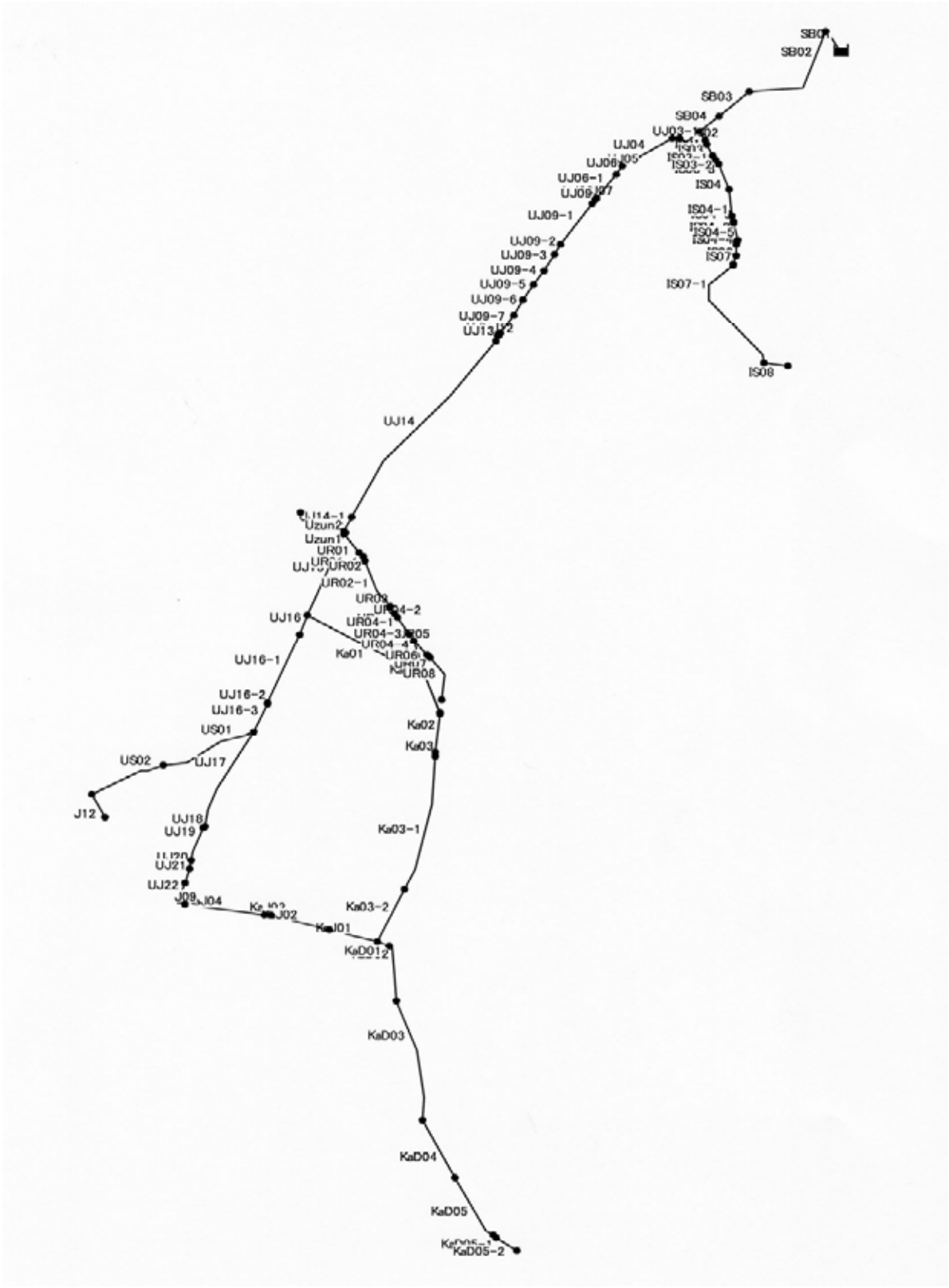

FIGURE 8.1.2 HYDRAULIC MODEL OUTLINE OF THE VAKHSH CONDUITS

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Project intake should have 10% allowance and accordingly it should be 155,000m^3/day at the intake in the Sarband SB facilities.

Regarding the capacity of intake, it seems to be possible to take 155,000m^3/day because the cross section area of intake channel is 2.6m^2 makes the velocity of flow only a little less than 0.7m/s.

(2) Hydraulic Analysis of the Vakhsh Conduits Based on Water Demand Prediction

1) Hydraulic Analysis

The Study Team made the hydraulic analysis making use of the hydraulic model of the Vakhsh Conduits explained in "3.3.9 Capacity of the Vakhsh Conduits under the Current Situation". The objective of the analysis is to establish appropriate model of Plan in order to introduce the sufficient capacity into the Conduits to meet the water demand in 2028.

2) Water Demand Loaded to the Conduits in the Analysis

As aforementioned, there are a number of areas where the WSS does not exisit in target five (5) Rayons.

Following table shows the Rayon-wise comparison of the total water demands of the WSSs in 2028 based on the assumption described in "8.1.3 (2) Population Projection and (3) Water Demand Prediction" and that of the rayon. In this comparison, it is assumed that the number of WSSs will not change.

Table 8.1.11 Total Water Demand of WSSs and Rayon in 2028

Rayon	WSS (m^3/day)	Rayon (m^3/day)	Ratio
Bokhtar	4,255	23,177	5.45
Vakhsh	2,196	5,641	2.57
Dzhilikul	3,323	8,211	2.47
Kolkhozobod	8,575	13,541	1.58
Kumsangir	3,323	8,211	2.47

Note) The water demand for WSSs which take water from the canal is excluded in the Vakhsh Rayon
Source: own study

Followings are assumptions to introduce above mentioned "non-water supply" into the hydraulic analysis:

- The Vakhsh Conduits will deliver water to the areas where WSS does not exist
- Each WSS is the point to load the water demand on the Vakhsh Conduits (outflow of water takes place at the point of WSS)
- The water demand at the above-mentioned point is the MDWD of the WSS times ratio shown in the *Table 8.1.11*.
- Inflow to WSSs is regulated with a valve and accordingly discharge will never exceed the water demand mentioned above.
- The water demand of Rayon Centers is the predicted one in 2028
- Discharge is constant during 24 hours

Attached Table 8.13 (Supporting Report) shows the MDWD represented by liter/second unit in 2028 of each WSSs and the water demand (total is equivalent to the total of the MDWD on the Vakhsh Conduits in 2028) applied to the hydraulic analysis.

3) Lessons Learned from the Hydraulic Analysis

Hydraulic analysis gave several points to consider in the Plan:

Insufficient Capacity of Pipeline between the Sarband Settling Basin and Uzun Pumping Station

Negative pressure takes place in the vicinity of Uzun PS by loading of MDWD of the WSSs only. It is consequently impossible for the Conduits to deliver total water demand in 2028 without expansion of this section in the Conduits.

Critical Point regarding Flow Rate of the Vakhsh Conduits

As shown in *Figure 8.1.2*, the single pipeline comes to Uzun PS and then it starts the ramification and finally four (4) pipelines appear representing by zone D, E, F, G, H, I. There are Rayon Centers, etc. which have big water demand at the end points of the zone D, E, G, H. Unless there is sufficient dynamic pressure at Uzun PS (it represent the position of the Conduits and hereinafter there are similar descriptions), necessary water accordingly will not come to the end of each pipeline. Hydraulic Analysis shows that existing 700mm in inside diamter (hereinafter referred to as ID700) can not maintain the sufficient dynamic pressure to deliver water to all the WSSs in the downstream area of Uzun. It is necessary to expand the conduit between Sarand Settling Basin and Uzun PS.

Conveyance to G Area is Difficult from the Viewpoint of the Costs

The conduit to Dusti (The Kumsangir Rayon Center) starts the connection point where around 4.2km to the south-west of Uzun in D area and go through nearby point of the south of Kolkhozobod Rayon Center and then go southward until Dusti via Kalinin PS. It extends up to Kolkhoz Lenin WSS (Q-04). Most of the conduit has ID514mm and the total length is around 40km. The elevation of Q-04 is 390m and that of Uzun is 364m, Q-04 is 26m higher than Uzun in elevation.

Total water demand of G in 2028 is 206 liter/second (17,900 m^3/day) and it necessitates around 126m water head energy to deliver this flow rate to Q-04 from Uzun. However, the elevation difference between the Sarband SB and Uzun PS is only 80m, it is impossible to deliver the said discharge from Uzun to Q-04 through existing conduit even if there is not any friction loss head between SB and Uzun PS.

Decreasing the friction loss head between Sarband SB and Uzun PS by the expansion of the conduit and expansion of around 40km of conduit between Uzun PS and Q-04 will make it possible to deliver necessary water to G area. However, the cost of expansion seems to be very expensive for the conveyance of only 17,900m^3/day.

Kalinin PS makes currently convey water to Dusti by pumping up from the Kumsangir canal. Kumsangir canal flows nearby area of the WSSs in Kumsangir Rayons. It seems to be more economical if respective WSSs or group of WSSs construct a water treatment plant by pumping up water from the canal than having water from the Vakhsh Conduits by expansion.

Furthermore, the exclusion of G area from the service area of the Vakhsh Conduits will bring following merits:

- To decrease the load on the conduit between the Sarband SB and Uzun
- To restrain the project cost
- To make it possible to convey water from Sarband SB to other areas by gravity

Regarding the water right to take water from the Kumsangir canal, it does not seem to be problem because the Kumsangir canal connects with the Stalin canal, if only RWSA will be able to set the water right for the necessary volume of water mentioned earlier.

Expansion of Conduits to and in H area

Around 9.6km of ID313mm steel pipe in H area connects with the Vakhsh Conduits in D area at around 10km to the south-west of Uzun. The maximum flow rate in 2028 of the conduit for Dzhilikul at just after Uzun is 458 liter/second and that of just after the connection point with the conduit for F area which locates around 4.2km to the south of Uzun is 246 liter/second. These flow rates consume around 77m water head energy between Uzun and the connection point with the conduit of H area.

Followings are rough calculation of the total water head at the said connection point in 2028.

- Elevation difference between Uzun and the connection point is only 8m
- Available dynamic pressure at Uzun in 2028 is around 55m water head after the expansion of conduit between Sarband SB and Uzun
- Total water head at Uzun = 364m (elevation of Uzun) + 55m = 419m
- Total water head at the connection point = 419m – 77m + (364m – 356m (elevation of the connection point)) = 350m < 356m (elevation of the connection point)

It shows that there is a negative pressure at the connection point in 2028. Namely, the current Vakhsh Conduits in D area can not convey necessary water to H area in 2028.

Moreover, the connection points of the WSSs in the downstream area of the connection point in D area will have the negative pressure because there is not enough elevation difference between such WSSs, of which elevation is 350m to 355m, and the connection point.

It is consequently necessary to lay the new conduit from Uzun to the connecting point to connect with the conduit in H.

Insufficient Diameter of Several Connecting Pipelines between the Vakhsh Conduits and WSS

The Diameter of Several connecting pipelines between the Vakhsh Conduits and the WSS will become insufficient with increasing the water demand. These pipeline should be renewed appropriately.

Pumping Stations

The hydraulic analysis result shows that energy increase of flow by the operation of the Bokhtar Head PS will cause higher friction loss head between Bokhtar Head PS and Uzun PS and most of increase energy is consumed by the Uzun PS. Considering this inefficiency, the Study Team did not include the operation of the Bokhtar Head PS in the Plan.

The Study Team discussed about making use of Uzun PS as the booster PS for the conduit with ID514mm in D area which has insufficient capacity as mentioned above. However, the flow rate of the conduit in 2028 is 252 liter/second after deduction of the flow rate to G area and the velocity is 1.2m/second. It exceeds the efficient velocity of pump operation, 1.2m/second and therefore, the position of Uzun PS is not appropriate as the booster PS. The Study Team consequently did not consider the Uzun PS in the Plan.

The Kalinin PS currently pump up water from the Kumsangir canal and make pump pressurized conveyance to the Dusti and Dzhilikul WSSs. When the Plan is realized, the water conveyance to Dzhilikul is made by gravity from the Sarband SB. As for the Dusti WSS, as mentioned already, the Team recommended constructing independent WSS. After all, the Kalinin PS will stop its work after the construction of the WSSs in G area which take water from the Kumsangir canal.

(3) Alternative Plans

1) Location of Water Treatment Plant

There are two (2) ways to locate the water treatment plant; one is centralized and the other is decentralized. Specifically, the former is to locate the plant near the Sarband SB or Bokhtar Head PS and the latter is to locate near respective WSSs or groups of WSSs.

In case of a centralized water treatment, the WSS has to distribute the treated water to WSSs through the existing Vakhsh Conduits. However, considering the pipe material of Conduits, which does not have an internal protective lining though the outside is coated with asphalt, and its age, the condition of the conduits might have deteriorated to some extent. Internal corrosion of iron pipes decreases their structural durability and may create leaks and at worst may cause a rupture, and also consumes disinfectant residual, accumulates deposits, creates encrustations and biofilms and consequently decreasing the pipe cross section, i.e. decrease the capacity of the Conduits.

As discussed earlier, one of the factors which influence the sustainability of the Plan is "the differentiation between the waters of irrigation canal and pipe supply". If the water quality of the piped supply is poorer than that of the water of irrigation canal, the consumers will not use the piped water supply so much. For example, the scales, sediments, biofilms, etc. in the conduits detaches from the inner surface might put color and odor to the supplied water and it has the population who shall be the consumer of the WSS return to the conventional water sources such as irrigation canals, shallow wells, etc.

Considering the potential of the Vakhsh Conduits to deteriorate the water in terms of aesthetic and microbial quality, it should be avoided to utilize the Vakhsh Conduits to distribute the treated water.

There is an option to adopt the centralized treatment method by applying in-situ pipe cleaning and lining, however, it is extremely expensive. Even if the decentralized water treatment plant is constructed, it necessitates the construction cost, i.e. the cost of cleaning and lining is net increase of the project cost. Hence, the Study Team can not recommend adopting this option from the viewpoint of the cost efficiency.

In Japan, uncoated steel pipe and galvanized steel pipe are not considered as service and distribution pipe.

The Study Team consequently recommends establishing decentralized water treatment system.

2) Water Supply to Kolkhozobod Rayon Center

As mentioned in "8.1.4 (2) Hydraulic Analysis of the Vakhsh Conduits Based on Water Demand Prediction", the dynamic pressure at Uzun affects the conveyance of water to the downstream area of Uzun. The decrease of water demand in the downstream area accordingly makes the Conduits hydraulically stable and it contributes the decrease of the cost of rehabilitation.

Though, the WSS of Kolkhozobod Rayon Center currently have water from the Conduits, it pumped up water from the Kumsangir canal which runs just aside the WSS.

Therefore, if the cost of water from the Vakhsh Conduits is higher than that of pumping up from the canal, the Vodokanal of Kolkhozobod probably will change the water source from the Conduits to the Kumsangir canal. In fact, in case that the cost recovery of the Plan targets the Vodokanal, such change will take place easily.

Consequently, the Plan considers the alternative of supplying or not supplying water to the WSS of Kolkhozobod Rayon Center. In case no supplying water, the target WSSs are those connects with the conduits between Kolkhozobod Rayon Center and the valve located 3.3km before the Center. Because this section is the property of the Vodokanal. Total number of WSSs will be excluded from the Plan is seven (7); R-05, R-04, R-32, R-37, R-38, R-06, R-30 including that of the Rayon center (R-05) and the total water demand including the water demand of non-water supply area is 102 liter/second (8,800m^3/day)

Among seven (7) WSSs, the elevation of R-05 is the highest and the distance between the

farthest WSS and R-05 is around 2.4km. Hence, the distribution by gravity from the R-05 is better than having water from the Vakhsh Conduits which makes a long distance conveyance.

(4) Rehabilitation Plan

1) Vakhsh Main Conduits

The Plan intends to limit the repair and rehabilitation of existing conduits to repair the parts where the parties concerned has already recognize the leakage, etc. The Study Team recommends making out the drawings which shows the conduit routes with elevation, length, thickness of soil cover, etc, social and natural settings along the Conduits, etc. through the detailed survey to be implemented at the initial stage of the Plan. Then RWSA will be able to maintain and/or improve the performance of the Conduits as current OM/M. The Plan consequently does not have the rehabilitation plan of the existing conduits. However, the renewal of existing gray cast iron pipe is projected to renew due to following reasons:

- Low performance against shock power
- Socket joint necessitates thrust concrete blocks, restrained couplings, etc. to the uneven force caused by the pipe inner flow is necessary
- Low performance of earthquake protection (Khatlon Oblast exists in the seismic zone)
- Degradation of hydraulic performance and water quality caused by incrustation, etc.

Besides, if the rehabilitation work finds out leakages, corrosion, etc., they will be repaired or partially renewed.

Followings are proposed rehabilitation plan of the Vakhsh Conduits based on the water demand prediction and the hydraulic analysis:

Rehabilitation Plan of the Vakhsh Conduits

a) installing the valve, which has a good functions to control flow rate, in all the conduits which connect the Vakhsh Conduits with the WSSs and the flow-meter to manage the volume of water delivered to the WSSs.

b) disconnecting G area and the WSSs of Kolkhozobod Rayon Center and six (6) WSSs (R-04, R-32, R-37, R-38, R-06, R-30) in the vicinity of it from the service area of the Vakhsh Conduits

c) renewal of existing pipe by equivalent or more grade pipe in the following sections which the RWSA reported.
  * 350m of ID1200mm concrete pipe in the section between Sarband SB and Bokhtar Head PS
  * around 3.2km of ID700mm steel pipe in the B area

d) to replace the existing ID313mm steel pipe of 7.8m in H area by ID414mm steel pipe

e) installation of ID996mm steel pipe with around 7.7km long from the Sarband SB to juction of B and C area. This conduit should make a short cut without going through the Bokhtar Head PS. The conduit in the C area connects with this new conduit.

f) installation of new ID414mm steel pipe with around 10.2km long between Uzun and the junction of the D and H areas and connection with the existing ID700mm steel pipe at Uzun and newly installed ID414mm steel pipe in the H area. Disconnecting the conduit in the H area from the existing ID514mm steel pipe in D area.

g) installation of iD720mm steel pipe with 25.4km long in parallel with the conduit in the B area and connection with newly installed ID996mm steel pipe in the A area and the existing ID514mm conduits of D and E areas.

h) disconnecting the conduit in the F area from the conduit between Uzun and Dzhilikul and connecting the conduit in the F area with newly installed ID414mm steel pipe from Uzun to the H area.

i) to replace the existing CIP ID600mm by ID614mm steel pipe in the section between the connection point of the existing steel pipe and CIP, and WSS of B-24. Length is around 400m. This newly installed steel pipe should be stopped just after B-24 by installing a valve for a wash out. There is a irrigation canal nearby.

j) installation of ID614mm with around 500m long steel pipe between the new junction of the conduits in the A , B and C areas and the WSS of V-15 in parallel with existing ID614mm steel pipe. V-15 will have water from this new conduit.

The capacity of the Vakhsh Conduit after the above mentioned rehabilitation is around 78,200m^3/day.

Alternative Plan

a) same as a) of above-mentioned rehabilitation plan

b) disconnecting G area from the service area of the Vakhsh Conduits

c) – f) same as c) – f) of above-mentioned rehabilitation plan.

g) installation of ID820mm steel pipe with 25.4km long in parallel with the conduit in the B area and connection with newly installed ID996mm steel pipe in the A area and the existing ID514mm conduits of D and E areas.

h) – j) same as h) – j) of above-mentioned rehabilitation plan.

The capacity of the Vakhsh Conduit after the above mentioned alternative rehabilitation is around 84,100m^3/day.

2) Vakhsh sub-main Conduits (from Main Conduit to a WSS)

The diameter of the sub-main conduit to several WSSs will be insufficient with increasing water demand. Following table shows the rehabilitation plan. High density polyethylene pipe (HDPE) is applied to the sub-main conduit to the WSSs, which are projected to construct a water treatment plant, and steel pipe is applied to the WSSs which are supposed to have water from the centralized water treatment plant of several WSSs.

Table 8.1.12 Renewal Plan of Sub-main Conduits

area	WSS	existing conduit				renewed conduit			
		Material	ID	C	length (m)	material	ID	C	length (m)
C	V15	SP	234.0	44	57	SP	414.0	110	57
	B08	SP	81.0	55	1,189	HDPE	110.2	110	1,189
	B09	SP	81.0	55	968	HDPE	123.4	110	968
E	R38	SP	68.0	44	223	HDPE	141.0	110	223
F	R15	SP	156.0	55	409	SP	234.0	110	409
H	J12	SP	208.0	55	1,257	SP	208	110	1,257
	J13	SP	313.0	44	1,747	SP	313.0	110	1,747

Note: SP- Steel Pipe, HDPE- High Density Polyethylene Pipe, ID- Inside Diameter
C- Hydraulic factor related to the roughness of pipe inner surface; the value is as of 2028 (the "C" value of SP decreases with aging)

Table 8.1.13 shown in the following page presents the overview of the rehabilitation plan.

Table 8.1.13 The Rehabilitation Plan Overview of the Vakhsh Conduits

Pipe	N.D. (mm)	I.D. (mm)	existing (m)	to abandoned (m)	to be renewed (m)	to be installed (m)	total (m)
Main							
SP	1220	1192	5223				5223
SP	1020	996	3975			7669	11644
SP	920	900	8030				8030
SP	720	700	16330	3151	3151	25443	41773
SP	630	614	6194			885	7079
SP	530	514	54044	3000			51044
SP	426	414	3215	3215	7840	10214	18054
SP	325	313	17773	9141			8632
Concrete	1200	1200	1229	350	350		1229
CIP	600	600	7526	7526			0
CIP	500	500	8984	8984			0
sub-total			132523	35367	11341	44211	152708
Sub-main							
SP	426	414			57		57
SP	325	313	2199	1747	1747		2199
SP	273	262	50	50			0
SP	245	234	57	57	409		409
SP	219	208	6583	4979	1257		2861
SP	150	156	1745	409			1336
SP	140	132	533				533
SP	133	124	217				217
SP	114	105	7171				7171
SP	89	81	3155	2157			998
SP	76	68	737	223			514
SP	32	36.7	71				71
SP	25	27.9	192				192
SP	20	24.1	23				23
HDPE	225	198.2	287				287
HDPE	160	141			223		223
HDPE	140	123.4			968		968
HDPE	125	110.2			1189		1189
HDPE	110	96.8	383	166			217
HDPE	50	40.8	49				49
CIP	200	200	435				435
CIP	150	150	3973				3973
CIP	100	100	1723	123			1600
PVC	225	207.8	50	50			0
PVC	160	147.6	64				64
PVC	110	101.6	231	8			223
PVC	40	36.2	442				442
sub-total			30370	9969	5850	0	26251
total			162893	45336	17191	44211	178959

Note：SP – Steel Pipe, HDPE – High Density Polyethylene, CIP – Gray Cast Iron Pipe, PVC – Polyvinyl Chloride,

3) Pumping Facilities

According to the rehabilitation plan of the Vakhsh Conduit, the water is drawn by gravity to Kalinin. Therefore, it is not necessary to rehabilitate pumping stations.

(i) Bokhtar Head Pumping Station

The reason mention above, this pumping station isn't necessary. So rehabilitation will not be implemented.

(ii) Uzun Pumping Station

The reason mentioned above, this pumping station isn't necessary. So rehabilitation will not be implemented.

(iii) Kalinin Pumping Station

This pumping station will continue to be used till 2012 in this rehabilitation plan of Vakhsh Conduits. Prediction of water demand in 2013 in the area is 3,177 m^3/day (=132 m^3/h) where this pumping station will distribute.

It is enough to cover this water demand with using one existing pump that has a specification (320 m^3/h, 50m), so it is not necessary to rehabilitate. Intake pumps have enough condition to continue to work till 2012 if regularly maintenance is going well.

4) Water Treatment Plant

As mentioned in the section "8.1.4 Rehabilitation Plan, (3) Alternative Plans, 1) Location of Water Treatment Plant", though the Study Team proposed to construct a WTP in the vicinity of a WSS, the Team also planned to make the scale of WTP big by grouping existing WSSs and accordingly decreasing the number of WSSs to be constructed. Followings are the reasons:

- the bigger the capacity of WTP is, the less inexpensive the unit construction cost of water to be treated providing that the water treatment process is same.

- the more the number of WTPs increases, the more the number of staffs for the WTP increases and accordingly the fixed cost of WTP operation as well as the water rate to be applied increase.

WSSs which meet the following condition are grouped: "Around 20m or more water head of dynamic pressure should be secured at the entrance of WSSs when an elevated tank with 20m height is constructed in the vicinity of the WTP which connects with the WSSs through the appropriate diameter of conduit regarding flow rate" In practice, if a site of which elevation is 20m or more higher than that of the WTP is available, the construction of semi-buried tank should have the priority.

The Plan assumed that WSSs can distribute water by gravity providing that the dynamic pressure at the entrance of WSSs is at least around 20m water head. It consequently necessitates to study the change of inflow conduit route in order to have higher dynamic pressure then 20m water head or necessity of booster PS in the distribution system at the implementation stage.

Above mentioned plan includes the WSSs operated by the Vodokanal to avoid the construction of a number of small scale WTPs in the Study area due to the difference of operator. Institutional arrangement regarding the Rural Water Supply will be necessary at the implementation stage.

Though the Scope of Study does not cover the WSSs in Bokhtar Rayon, the Study Team incorporated them into the planning and made the hydraulic analysis to prepare the rational Plan.

Projected WTPs are shown in *Attached Table 8.14*. shows the projected WSSs with the maximum daily water demand to them and *Figure 8.1.3* presents the location of projected WTPs with the WSSs connected.

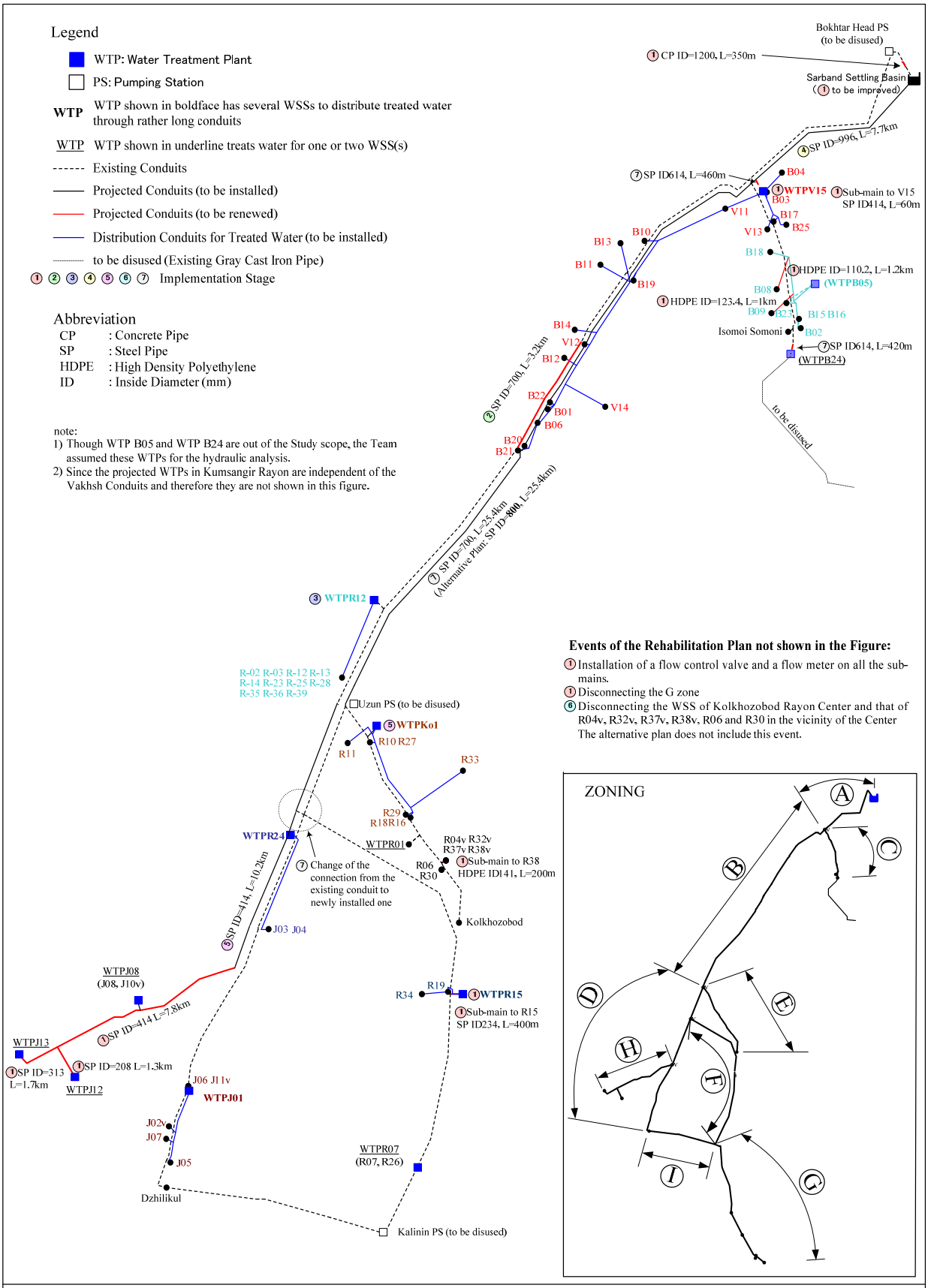


Figure 8.1.3 Outline of the Rehabilitation Plan for the Vakhsh Conduits

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA

(i) Selection of water treatment method

Nature of water source is as follows.

- Type of Water Source：Irrigation canal,
- Water quality：Average conductivity in rainy season about 10-30NTU
- Temperature：5 to 25 degree Celsius

(ii) Treatment method

The rapid sand filtration method (auto filter type) is applied as the treatment method. Following facilities are included in the treatment plant.

a. Backwashing pump

Large output is required. The view point of energy saving is considered. Backwashing method by gravity flow is applied considering the frequent power failure. Required number of filter is more than eight (8). If the number of filter is less than eight (8), water in the auxiliary tanks and elevated tanks to increase the backwashing ability.

b. Surface washing pump

Pressurized water is used for backwashing because 0.3MPaof pressure is required. However, emergency power generator can be used when electric power failure since high pressure is not required. In order to prevent freezing in winter season, filters are covered by transit shed. Surface lying pipes are protected by heat insulating material.

c. Suspended solid contact clarifier

Horizontal baffled channel flocculation method is applied for the coagulation basin. The method is also applied for suspended solid contact clarifiers, considering frequent electric power failure and saving energy.

There are two (2) types in the baffled channel flocculation method. The Horizontal baffled channel flocculation method is preferable to avoid freezing in the winter season. Even if weak freezing is happened, the method is not affected to its function.

d. Sedimentation basin

Horizontal flow type is applied for the sedimentation basin. If capacity of the basin is large, vertical shaft type scraper is used for desludging. Average conductivity in the winter season is 10 to 30 NTU. Due to low conductivity, sedimentation of sludge is not much. However, it is preferable to install a scraper to make desludging easy. If the capacity of the filter is not large, only bottom desludging hopper is installed because manual desludging is easy. In order to prevent freezing in winter season, inlet and outlet are covered by transit shed. Surface lying pipes are protected by heat insulating material.

d. Coagulant

Aluminum sulphate is generally used as the coagulant. Effect of aluminum sulphate is declined under the low temperature in the winter season. Therefore, it is preferable to use either coagulation aid or polyaluminium chloride. However, using of both coagulators at the same time shall be avoid because they will be consolidated and plug the inside of the pipes.

e. Chlorination

Chlorine feeding is indispensable to avoid water deterioration during the distribution. Calcium hypochlorite is used as the chlorine agent.

(iii) Wastewater treatment facility

Wastewater and sludge are stored in the temporary sedimentation tank. Then, supernatant is discharged to channels. Since capacity of 14 treatment facilities out of 15 is less than 10,000 m3/day, volume of wastewater from the treatment facilities is not large.

Deposited sludge shall be periodically baled out. Then, it is air drying or disposed to the repository site.

Sludge drained from the treatment facilities contains small amount of aluminum, however, it cause no negative impact to environment. Therefore, it is available as joint soil of turf and backfilling material after processed.

(iv) Mechanic and Electric Facilities

Mechanic and electric facilities are designed by following basic concepts;

- Solid, long life
- Decreasing maintenance work
- Well used ordinary equipments as possible
- No excessive specification. (ex. puissance)

a. Pump

Basically, pump will be selected type of single or multi stage spiral and horizontal installation. For the chemical injection facility, pump will be used type of Diaphragm pump of constant flow rate. But on the situation, as quality of liquid, piston pump, plunger pump and rotary pump will be selected.

Total height manometer and flow rate are different by facilities. When the pump is selected, pipe resistance (roughness) as well as total height manometer and flow rate must be well considered.

For the shield axis of pump, mechanical type without using water will be recommended.

Some pumps like large capacity (intake pump or distribution pump) and pumps for chemical injection facility are recommended the Japanese products, but other pumps will be selected in the market of this country.

b. Electric Motor

Electric motor is used type of low voltage three phased induction motor with a squirrel-cage type rotor, because this type of electric motor is solid and easy maintenance. Less than 100kW of capacity, low voltage (380V) one will be used, but more than 150kW is needed, high voltage one will be selected. Type of wound-rotor induction motor won't be used because maintenance work is trouble-some job about treatment of brushes. If control of rotation speed is necessary with frequency control, inverter could be used. Specification of electric motor is shown in *Attached Table 8.16*.

Attached Table 8.16 Basic Specifications of Electric Motor

	Basic Specification	Remarks
1. Structure	Three phased induction motor with a squirrel-cage type rotor	
2. Protection Structure	IP54	There's much dust particles
3. Normal rotation speed	1,500 /min	
4. Voltage	380V	A small motor like under 1kW of capacity, three-phased or sigle-phased 220 V will be used
5. Frequency	50Hz	Frequency will be adapted to Commercial power
6. Insolation, Heat Resistance Level	Class F	(Max. admissible temperature of coil: 155℃)
7. Paint	Rust proof	
8. Time Rating	Continuous Rating	
9. Starting method	Selection from among ; Direct (Under 3.7kW), Star-Delta (From 5.5 to 37kW), Reactor (Over 45kW)	

c. Valves

Valves which used in water treatment plant without closing valve has already mentioned in the part of aqueduct, there are for control, for prevention of backward flow and for removing air etc.

a) Closing and control valve

For the reference of specifications, See the *Attached Table 8.32* in 1) Valves of (4) Ancillary Facilities of the Conduits (Valves, Wash Outs, Instrumentation Equipments, Water Pipe Bridge).

b) Check Valves

Check valves type swing is used at point of outlet of pump for prevention of backward flow. Capacity pressure is 0.98 Mpa, inside paint is powdered epoxy resins paint.

c) Air Valves

Air valves of antifreeze type must be installed in the center of water pipe bridge or some places where the air remains inside of pipe for removing air.

d) Special valves

Exhaust mud valve will be selected among type of Diaphragm, pinch valve or eccentric valve etc which have a little flow resistance at full open, because liquid contain sludge. For valves for chemical injection facilities, depending on the using liquid, it must be used anticorrosive and acid-resistant material at the section of contact of liquid.

d. High Voltage Incoming and Switching Panels

These Panels are to supply electricity to load equipments after receiving high voltage (10kV) of commercial power line. In this project, each water treatment plant (WTP) have one receiving line of electricity from the reason why each WTPs are small and cutting down of construction cost. But one emergency generator will be installed instead of second receiving line because there're many power failures in winter season. The voltage of emergency generator is 380 volts of low voltage and method of switching between

commercial line and emergency generator line is one of a mechanical interlock. A sample design of single diagram is shown in *Attached Figure 8.1.6 (Appendix)* Single Diagram of Water Treatment Plant of TV15. This is for the WTP that a maximum treatment quantity 40,000m^3/day in this project. Flowing articles are for general explication of main components applied for this project.

a) Disconnecting Switch

If the current flow the circuit like a load current or a short-circuit current, this switch can't be operational. In the time of maintenance, this switch is used for opening and discharging the circuit to no voltage.

b) Vacuum Circuit Breaker

This breaker can cut the large current like an over load current or a short-circuit current. This breaker is installed for protecting another feeder from extending incidents that broke out on this feeder of second side of this breaker. Section of opening and closing terminal is put in the vacuum chamber, so appearance of arc is so little at the moment of open circuit. So that the lifetime is longer than other type of arc extinguish.

c) Protective Relay

Protective relay has the role to detect failures like an over road, short-circuit or ground-circuit that occurs on the equipments (power line, electric motor, transformer etc.) through voltage transformer and current transformer, and to cut off the accident line by making circuit breaker work rapidly for the purpose which make accident area minimum to give the signal to prevent from extending the accident area to normal area. There're many type of protective relay, but the relay that will be used in these panels are an over current relay, an under voltage relay, an over current ground relay and a directional ground relay. The over current relay orders t to open the circuit to breaker when the current flow over a setting current. The under voltage relay protect the equipments from unusual voltage to order to open the circuit to breaker when the voltage become under a setting voltage. The over current ground relay protect the equipments from accident of ground fault. The directional ground relay has the function of the over current ground relay and has an additional function for avoiding a ground fault of another feeder.

d) Voltmeter, Ammeter, Wattmeter, Watt-hour meter

Using a voltage transformer and a current transformer mentioned above, these meters show an instantaneous current, voltage and electric power. Watt-hour meter show a cumulated electric power used until present.

e) Arrester

Arrester protects the cables and equipments from extremely and abnormal high voltages like a lightning. When a line voltage become over a setting voltage, arrester close the circuit and pass the abnormal high voltage to the ground, and protect an isolation of equipments from he abnormal high voltage. It is necessary for an arrester for low voltage to change after two or three times of function.

The ground must be applied a connection earth by the point of view of protection from lightning.

e. Transformer

Transformer is used for step-down from high commercial voltage to low voltage for using pumps. The capacity is different as each water treatment plant and the basic specifications are shown in *Attached Table 8.17.*

Attached Table 8.17 Transformer Basic Specifications

	Basic Specification	Remarks
1. Type	Oil cooling transformer	
2. Cooling Method	Natural oil circulation	
3. Voltage	Primary side：10,000V Secondary side：380V	On primary side, a tap changer will be atached
4. Phase	Three phases	
5. Capacity	(By case of scale of water treatment plant)	
6. Connection	Primary side：Delta, Secondary side：Star Neutral point will be grounded and the electric power will be distributed with three phase four line method.	

f. Generator

Generator must be selected one that can work continually for 24 ~ 72 hours. Prime motor will be selected a diesel engine, because of easy maintenance and most ordinary motor. The capacity of generator is calculated as one third of total capacity of WTP facilities. This reason is for minimum operation of WTP with distribution water of one third of WTP capacity. Three pumps of same capacity are designed as intake pump and also distribution pump. And so that while the generator works, one pump of intake pump and distribution pump and another small pump can work. Output voltage is 380V of low voltage because maximum capacity may be 200kW and it is easy to operate low voltage generator. The basic specifications are shown in *Attached Table 8.18*.

Attached Table 8.18 Generator Basic Specifications

	Basic Specification	Remarks
1. Type	Brushless synchronous generator	Continuous operation for from 24 to 72 hours
2. Prime Motor	Diesel engine	
3. Normal rotation speed	1,500/min	
4. Output Voltage	Three phase four line, 380V/220V	
5. Starting Method	Battery	
6. Capacity	(By case of scale of water treatment plant)	
7. Cooling System	Forced-water-cooled circulation	
8. Protection	High temperature of cooling water, oil pressure and temperature, Overroad generator	

g. Control Panel

A control panel for pump is explained as below. Power-supply of control and operation won't be used direct stabilized power-supply, it must basically be AC 220V. In this country in summer temperature is so high, so electronic equipments won't be used because they are weak for high temperature. The basic specifications are shown in *Attached Table 8.19*.

Attached Table 8.19 Basic Specifications of Control Panel for Pump

	Basic Specification	Remarks
1. Structure	For outside, freestanding, totally enclosed	Dust-resistance, Dripproof
2. Main Switch	Operational switch on the outside of door upper side	Structure that power line is switched off if the door is opened.
3. Breaker	Main breaker will be type of GFI (Ground - fault circuit interrrupter), installed at the top place inside the panel. One breaker is necessary for one electric motor.	
4. Thermal Relay	Included the open - pahse protection	
5. Lightning Arrester	Lightning arrester must be installed and connected to each phases of the cables comming from outside .	
6. Cable Connectiog Terminal Block	Terminal blocks for outside cables must be installed at the bottom inside of the pannel.	
7. Entrance Place of Cable	A base height about 50mm for fixing panel will be installed at the bottom of the panel and from there the outside cables will be inserted. Never insert the cables from upper position of panel.	
8. Ventilating Fan	Ventilation slots with filter will be made at the lower positon and ventilation slots with fan and filter will be made at the upper position of the door of panel.	
9. Light in the Panel	Fluorescent light (40W)	
10. Earth	Connection of panel body to a good protective ground	
11. Nameplate	Putting the nameplate of panel on the surfafe of outside and also putting the nameplates of pumps near the breaker and magnetic switch on the visible position inside of panel	

h. Hoist

Hoist on electricity will be installed neat the roof in the pumping station. Maximum lifting charge is five ton, one or two ton as scale of WTP will be considered.

i. Air Conditioning and Ventilation

a) Ventilation

In a warehouse, a control room, a pumping house, electric incoming and distribution room, generator room, ventilation facilities will be installed that take and evacuate air under power. Capacity of fan will be calculated with heat capacity that the equipments run and with heat capacity get into the room.

b) Air Condition

An air condition will be installed in the control room.

j. Illumination

Illumination will be selected fluorescent light for inside use and high brightness bulb like a high-pressure mercury lamp for outside use. Required luminance is different as each place. Referring the flowing in *Attached Table 8.20,* the number and position will be designed.

Attached Table 8.20 Necessary Illumination

Place	Illuminance	Light fixture type
Control room	500(lx)	Fluorescent light
Pumping house, Electric room, Warehouse	200(lx)	Fluorescent light
Outside power facilities	50(lx)	Fluorescent light for outside or High-pressure mercury lamp
Outside aisles	20(lx)	Fluorescent light for outside or High-pressure mercury lamp

(v) Measurement, Control and Watching Facilities

The purpose of measurement instruments is different as quality improvement, saving resources, improvement of safety performance, collecting data of operation etc. In this project, the purpose is to collect operation data and to improve the operation and facilities, and finally to progress the quality. And saving the constructing cost, WTP has minimum functions of measurement.

With this line, the plan is shown in *Attached Figure 8.1.7 Concept Design of Control Flow of Water Treatment Plant (Appendix)*. Intake facilities, chemical injection facilities and distribution facilities will be controlled automatically by flow rate or pressure. And the flow rate, pressure and water level etc. of other facilities will controlled by manual. And also water quality control like sampling, measurement and recording will be done by operators.

a. Flow Meter

Electromagnetic flow meter will be used because it is most applicable flow meter. And that's why measuring objects are liquids which is almost water and also there's minimum required straight length of pipe before this flow meter; 5D~10D

This flow meter will be installed at flowing places;

- For control of discharging rate of intake and distribution water
- For control of injection flow rate of chemical liquid
- For measurement of water from intake basin
- For measurement of water from filtering basin

b. Pressure Gauge

Pressure gauge will be used for measuring pressure at the point of pump outlet. For water pressure, type Bourdon is normally used. For the intake pumps or distribution pumps, it will be for control of pressure or flow rate, so that it is necessary to have a function to output the measuring pressure. Their some type generally have an electrical output like 4 ~ 20 mA. Then for measurement of chemical liquid, Diaphragm-seal type must be used to protect the instrument from chemical liquid.

c. Water Level Gauge

Water level gauge will be used mainly at the temporary charging well, the flock tank, sedimentation basin, filtration basin and distribution tank. In this plan, this gauge type float will be used for indicating these water levels to the control room.

d. Measuring Instrument of Water Quality

In this plan, minimum necessary items in WTP will measure. The operators will measure these items at regular interval not always, automatically.

a) Thermometer

Use the thermometer attached on instrument pH meter.

b) Turbid meter

Turbid meter which hardly receives the influence of measured water colors will be selected. There's large difference of turbidity, an automatic change range type is recommended.

c) pH Meter

Portable type with function of thermometer will be selected.

d) Conductivity Meter

Portable type

e) Residual Chlorine Meter

By using reagents, free residual chlorine and combined residual chlorine will be measured separately.

e. Operation and Monitoring Board

Facilities will be operated by manual and operation boards will be installed near the facilities. But for some part of important facilities, by installing a control room and then important operating measurements like flow rate of intake and distribution and important state of pump will be supervised together in the control room. Supervising items are shown in following *Attached Table 8.21*.

Attached Table 8.21 Basic Specifications of Operation and Monitoring Board

	Basic Specification	Remarks
1. Structure	Desk type for inside use	Dust-resistance, Dripproof
2. Display and Operation Item	Intake pump: Run／Hault lamp (Each pump one lamp)	
	Flow rate of intaking water (m^3／h), Pumping pressure of intake pump (Mpa)	
	Surface wash pump: Run／Hault lamp (Each pump one lamp)	
	Back wash pump: Run／Hault lamp (Each pump one lamp)	
	Distribution pump: Run／Hault lamp (Each pump one lamp)	
	Flow rate of distribution water (m^3／h), Pumping pressure of distribution pump (Mpa)	
	Water level :Higher limit / Lower limit (Flock tank, Sedimentation reservoir, Filtring tank, Distribution tank)	

5) Distribution Facilities

Water Distribution Conduits

This section describes the Plan on the conduits which connect the WTP and WSSs and the distribution system of respective WSSs are explained later. As aforementioned, the distribution system of WSSs will have water directly without installing a distribution tank from the WTP in

the Plan. The variation of water demand on the WSSs will consequently govern the diameter of conduits between the WTP and WSSs. The maximum hourly water demand on the WSSs is the condition to determine the diameter of conduits. *Attached Table 8.14* shows the maximum hourly water demand of each WSS in 2028.

The target conduits are those connects the WSS with three or more WSSs shown in *Table 8.15.*

Followings are design conditions:

- Flow rate : The maximum hourly water demand in 2028 to be loaded on the nodes, which represent the location of WSSs, in the hydraulic model comes from multiplying the average maximum daily water demand per hour by the time coefficient explained in the section "3.5 Underlying Difficulties in the Rehabilitation of the Vakhsh Conduits, (2) Establishment of Quantitative Service Level Indicator, 2)".
  Since the applicable data regarding the time coefficient is not available in Tajikistan, the Study Team determined the values of time coefficient based on the following mathematical expression derived from the data in Japan. *Table 8.1.14*shows the value of time coefficient to be applied to the Study.

  $K=2.7445(Q/24)^{-0.0726}$

  where K: time coefficient

  Q: maximum daily water demand

Table 8.1.14 Time Coefficient

Maximum Daily Water Demand (m^3/day)	Time Coefficient
<100	2.6
100-500	2.3
500-1000	2.1
1001-2000	2.0
>2000	1.9

- Elevation of WTP outlet : Elevation of WTP site + 20m (Construction of elevated tank or semi-buried tank on a neighboring plot where the elevation is 20m or more higher than that of the WTP site)
- Dynamic pressure at the entrance of WSSs
  : 20m water head at the minimum
- Pipe to be used and hydraulic factor related to pipe inner surface for having the friction loss head
  : High density polyethylene pipe, 110 is applied to the hydraulic factor considering the minor loss caused by valves,

etc. and long term use.

Attached Table 8.22 – 27 present he outline of them conduits layout by projected WTPs.

6) Ancillary Facilities

(i) Valves

The places where valves will be installed are designed following four categories.

- For branches of Vakhsh Conduits
- For branches of distribution main from water treatment plants to water supply system
- For separation of long pipeline of Vakhsh Conduits Main
- For water pipe bridges of Vakhsh Conduit

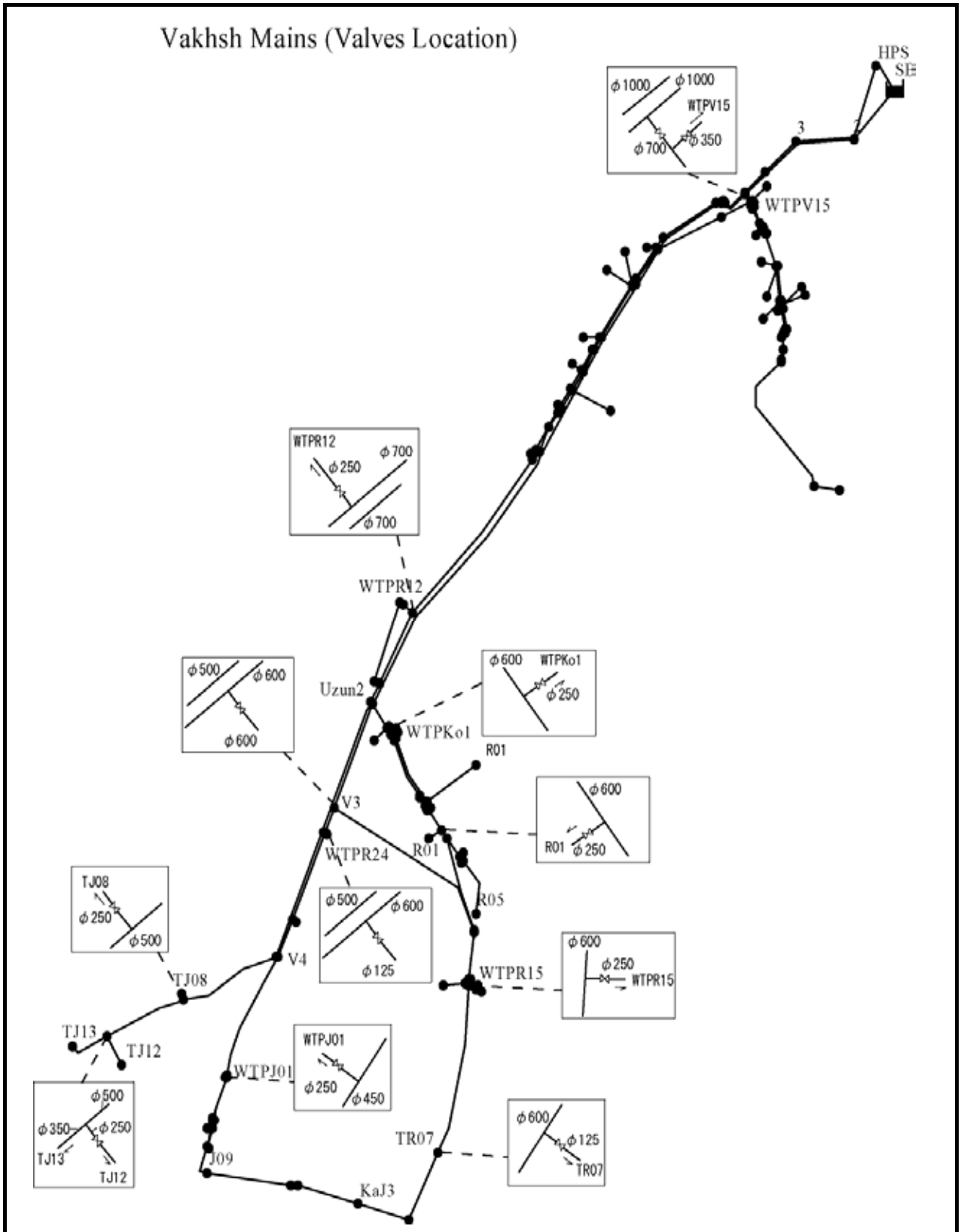
Total 13 valves will be installed at the Branches for each 11 water treatment plants and two point of Vakhsh Conduits Branch. These are shown in *Attached Table 8.28* (Appendix) Valves List for Branches of Vakhsh Conduits. These valves positions are shown in *Attached Figure 8.1.4.*

As the same way, valves list for branches of distribution main is shown in *Attached Table 8.29* (Appendix), valves list for separation of Vakhsh Conduits Main *in Attached Table 8.30* (Appendix) and valves list for water pipe bridges of Vakhsh Conduit in *Attached Table 8.31* (Appendix). The valves for separation of Vakhsh Conduits will be installed at the point of each length of 3 km.

About specifications of valve, stopping valve will be basically used for the pipeline. There are some kinds of type of valve, but they say that butterfly type is economic for pipe that diameter is more than 600mm and stopping type is economic for pipe that diameter is less than 600mm. Basic specification is shown in *Attached Table 8.32*.

Attached Table 8.32 Basic Specifications of Stopping and Control Valve

	Basic Specification	Remarks
1. Structure	Cone valve, butterfly valve, Stopping valve	― Over ϕ 600mm :butterfly valves under ϕ 600mm :stopping valve ― Cone valve will be used as flow rate control for pump with large diameter
2. Purpose	Stop, Control	Stopping valve are for closing the pipeline.
3. Operation Method	Manual or Electric	Under condition of over ϕ 400mm, purpose, installation place, electric type will be considered
4. Capacity Presure	0.98Mpa	
5. Paint	Powdered epoxy resins paint	
6. Other	Pipeline over ϕ 400mm, bypass pipe and valves will be installed	



Attached Figure 8.1.4 Valves Location of Junction Points on The Vakhsh Conduits

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(ii) Wash Outs

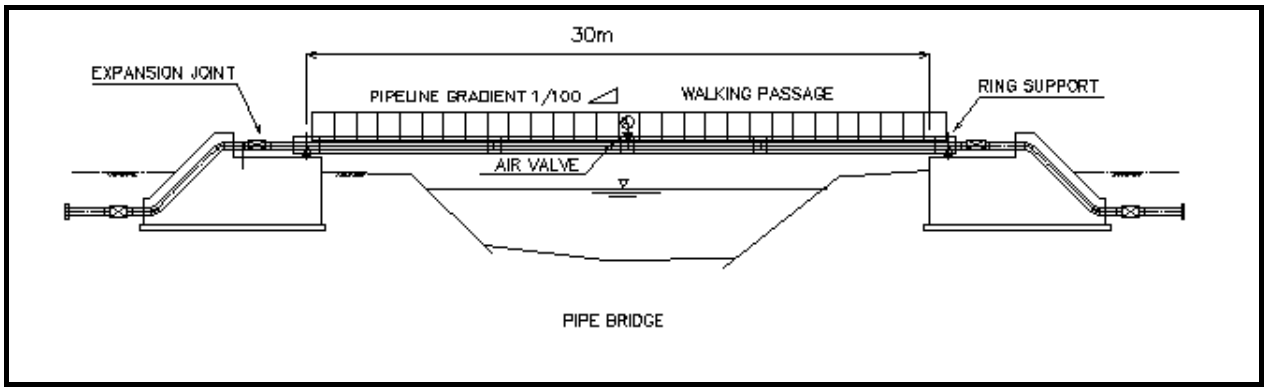
A wash out valve will be installed at the lowest place around Uzun pumping station. The drainage will draw to nearest canal.

(iii) Instrumentation Equipments

Flow meter must be installed for the purpose of control of discharging water and analyze for water leakage at after the settlement basin and four after junction points of branches of Vakhsh Conduits. Flow meter will be type of electro-magnetic, instant flow rate and added up flow rate can be readable in the valves box.

(iv) Water Pipe Bridge

Topography wasn't executed in this study, so correct places and quantity that the water pipe bridge must be installed aren't understood. But as the chief engineer of Vakhsh Conduits of RWSA explained that there are 23 points. The width of canals is 30 meters maximum. Then total 23 water pipe bridges will be programmed. Two valves will be installed before and after pipeline. General structure of water pipe bridge is shown below in *Attached Figure 8.1.5*.



Attached Figure 8.1.5 General Structure of Water Pipe Bridge

7) WSSs connected to the Conduits

This section describes the rehabilitation planning of distribution conduits of WSSs connected to the Vakhsh Conduits. The Study Team prepared the Plan in the following manner referring the Inventory Survey result.

Inside Diameter of Conduits

* In case of the distribution by gravity, it can be considered that multiplying the number of communal taps by their design flow rate is the flow rate used to determine the ID of distribution mains[2]. The Study Team determined the ID of projected diameter when the friction loss head of projected distribution mains caused by the maximum hourly water demand in 2028 or the flow rate mentioned above whichever is bigger matched approximately the friction loss head of existing distribution mains by the flow rate mentioned above.

The IDs of projected distribution sub-mains were computed applying the ratio of IDs of the

[2] The definition of the distribution main in the planning is as follows: The conduit which has the biggest inside diameter among the distribution conduits is the distribution main and the conduits which have smaller inside diameter up to two sizes than that of the distribution main are the distribution sub-main.

existing distribution mains and sub-mains.
Followings are the assumptions applied to the above-mentioned calculation.

- The design flow rate of communal tap is assumed as 0.1 liter/second based on the information of UNDP.
- The number of communal tap will not change.

* In case of the distribution by gravity with little information on existing facilities, the following conditions considering the assumption applied to the Plan that the minimum dynamic pressure at the entrance of WSSs is around 20 meters and the Inventory Survey result determined the ID of the conduits:

- the minimum dynamic pressure at the communal taps is 5 meters
- the maximum total loss head of the distribution conduits from the entrance of WSS to the furthest communal tap is 15 meters
- the friction loss head of projected distribution mains is 5 meters at the maximum

Above-mentioned method is applied to have the IDs of projected distribution sub-mains.

* In case of pump pressurized distribution, the relationship between pipe ID and flow rate for economical pump operation was applied to determine the ID of distribution mains. The flow rate to determine the ID of distribution main comes from the maximum hourly water demand in 2028. The same manner applied to the case of distribution by gravity determined the IDs of sub-mains.

* The WSS of R36 will not utilize the dynamic pressure given by the Vakhsh Conduit due to the realization of Plan. It was considered that this case is same as that of the distribution by gravity with little information on existing facilities.

Length of Distribution Conduits

* The calculation of projected length of distribution mains and sum-mains was made based on the assumption that the length increases in proportion as the population growth. However, the point to compute the length is the implementation year of the Plan explained later. Since the prediction of the service area expansion is quite difficult, it was assumed that the detailed design would be made based on the service area in the implementation year of rehabilitation work.

* In case that the WSS of which information on distribution conduits are not available, the ratio of distribution mains to sub-mains was assumed as 1 to 2.

Minimum Diameter of Distribution Sub-mains

* Since the Plan targets on the realization of yard connection, the Study Team proposed to apply 75mm of ID as the minimum diameter of distribution sub-main in order to secure sufficient dynamic pressure in the service pipe.

Material of Conduits

* The HDPE pipe was considered because the pipe can be procured in Tajikistan.

Utilization of Existing Conduits

* The HDPE pipe will replace the SP without inside coating and CIP which are not suitable to deliver treated water due to recontamination.

* PVC and HDPE pipes will not be replaced.

Attached Table 8.33-36 shows the quantity of projected distribution mains and sub-mains of targeted WSSs.

8.1.5 FACILITY DESIGN AND COST ESTIMATION（CIVIL WORK）

(1) Newly planned Water Supply Facilities in the Water Supply Area of Vakhsh Conduit

1) General Facility Design

This plan schedules to rehabilitate Vakhsh Transmission Pipeline, and constructs thirteen water treatment plants with intake facilities at vicinity irrigation canal and transmission/distribution pipe to supply water from new water treatment plant to existing water supply area along the Vakhsh Pipeline.

Adopted design standard is shown as follows.

The composition of the main facilities of the new WTP is shown as following.

- Intake facilities

  Intake Weir, Intake Grid, Sand Settlement Basin, Intake Pump Station, Raw Water Main

- Water Treatment Plant (WTP)

  Receiving Well, Coagulation and Sedimentation Basin, Rapid Sand Filtration Basin, Distribution Reservoir, Distribution Pump Station, Sludge Lagoon, Transmission Main/Distribution Main

If necessary, elevated tank should be installed.

Table 8.1.15 Adopted Design Standard (Excluding Mechanical Equipment)

Kind of facilities	Design Standard	Standard Value	No. of Basin/ Component	Remarks
Intake weir, intake grid	-	-	-	According to intake amount, water level and surrounding ground level.
Sand Settlement Basin	Retention Time	About 15minute	2basins	
Receiving well	Retention Time	About 1.5minute	2basins	
Chemical Sedimentation Basin	Baffling Type			
-Coagulation Basin	Retention Time	About 45minute	2basins	（Baffling Basin）
-Sedimentation Basin	Surface Load	15－30 mm/min	2basins	Area of Basin÷Volume
	Velocity	>0.4 m/min		Sectional area of flow direction of Basin÷Volume
Rapid Filtration Basin	Filtration Speed	120-150 m/day	About 8-12basin Including 1standby Basin Totally 20% standby capacity	Small *WTP: Less than 8basin Refer to Patterned Drawing: A,B,C,D
Reservoir	Retention Time	6 hours	1Basin 2Tanks	
Transmission /Distribution Main	Velocity	Less than 3m/s		

Note, *WTP：Water Treatment Plant

2) Patterned Design of Water Treatment Plant

As for newly proposed Water Treatment Plants (WTP) are scheduled to be set up in fifteen places in the existing water supply areas along the Vakhsh Transmission Pipeline. As a lot of numbers of Water Treatment Plant (WTP) is planed in this study. Some standard type of

designs (patterned design) of the facilities is made according to the structural condition, and the construction cost is estimated according to the patterned design. Developed patters of facilities of proposed Water Treatment Plants and patterned design of Water Treatment Plants are shown as follows.

The following patterns of facilities are collectively described in each figure.

- *Attached Figure 8.1.8* Site Facility Arrange Plan
  - Type A in capacity of 1,000-4,500m^3/day
  - Type B in capacity of 6,400-8,200m^3/day
- *Attached Figure 8.1.9* Site Facility Arrange Plan
  - Type C in capacity of 40,000m^3/day
  - Type D in capacity of 80,000m^3/day
- *Attached Figure 8.1.10* Structural Drawing of Coagulation ands Sedimentation Basin
  - Type A in capacity of 1,000-4,500m^3/day
  - Type B in capacity of 6,400-8,200m^3/day
  - Type C in capacity of 40,000m^3/day
- *Attached Figure 8.1.11* Structural Drawing of Rapid Filtration Basin
  - Type A in capacity of 1,000-4,500m^3/day
  - Type B in capacity of 6,400-8,200m^3/day
- *Attached Figure 8.1.12* Structural Drawing of Rapid Filtration Basin
  - Type C in capacity of 40,000m^3/day
- *Attached Figure 8.1.13* Structural Drawing of Rapid Filtration Basin
  - Type D in capacity of 80,000m^3/day
- *Attached Figure 8.1.14* Distribution Reservoir
  - TYPE A /BAND C

The Drawings are shown in the end of this Chapter.

Table 8.1.16 Proposed Water Treatment Plant

NO	Name of Proposed WTP	Estimated Demand (m^3/day)	Total Necessary Filtration Basin Area (m^2)	Type of WTP	WTP Pattern Code	Patterned Nominal Capacity	Filtration Max. Speed	Number of Basin
						(m^3/day)	(m/day)	Including 1Stanby Basin
1	TR-01	900	6.7	Type A	A-1200	1,200	150	4
2	TJ01	3,600	26.7	Type A	A-4400	4,400	150	12
3	TK01	5,100	40.0	Type B	B-6400	6,400	150	8
4	TR24	1,200	13.3	Type A	A-1200	1,200	150	6
5	TV15	38,400	266.7	Type C	C-40000	40,000	150	10
6	TR12	7,800	53.3	Type B	B-8200	8,200	150	12
7	TR15	2,700	20.0	Type A	A-3500	3,500	150	10
8	TR07	2,400	20.0	Type A	A-2800	2,800	150	8
9	TQ04	6,600	46.7	Type B	B-8000	8,000	150	10
10	TQ05	4,800	33.3	Type B	B-6400	6,400	150	8
11	TQ06	2,100	20.0	Type A	A-2800	2,800	150	8
12	TQ02	1,800	13.3	Type A	A-2000	2,000	150	6
13	TJ-12	1,800	13.3	Type A	A-2000	2,000	150	6
14	TJ-13	1,500	13.3	Type A	A-2000	2,000	150	6
15	TJO8	4,500	30.0	Type B	B-6400	6,400	150	8
	TOTAL	77,400				93,300		

Attached Table 8.37 Typical Sedimentation Basin

NO.	WTP Pattern Code	Type of WTP No.	Patterned Nominal Capacity (m^3/day)	No.of Basin	Dimension of Basin		Coagulation Basin		Sedimentation Basin		Total Aria (m^2)	Total Outer Size	
					Width B (m)	Depth D (m)	Length L (m)	Volume B*L*H (m^3)	Length L (m)	Volume B*L*H (m^3)		Outer B (m)	Outer L (m)
P1	A-1,200	Type A	1,200	2	2.6	3.0	2.0	15.6	10.8	168	105	5.6	18.8
P2	A-2,000	Type A	2,000	2	3.3	3.0	3.0	34.2	12.4	255	146	8.0	20.9
P3	A-2,800	Type A	2,800	2	3.8	3.0	3.0	34.2	14.4	328	187	8.0	23.4
P4	A-3,500	Type A	3,500	2	4.3	3.0	3.0	38.7	15.9	410	224	9.0	24.9
P5	A-4,400	Type A	4,400	2	4.5	3.0	3.0	40.5	16.5	446	240	9.4	25.5
P6	B-6,400	Type B	6,400	2	6.0	3.0	4.0	72.0	21.0	756	384	12.4	31.0
P7	B-8,200	Type B	8,200	2	7.0	3.0	5.0	105.0	24.0	1008	504	14.4	35.0
P8	C-40,000	Type C	40,000	4	10.0	3.7	6.0	222.0	35.0	5180	1,958	40.8	48.0

Attached Table 8.38 Required Dimensions of Facilities and Land

NO	WTP Pattern Code	Type of WTP	1. Filtration Basin Outer Basin Area (m^2)	2. Sedimentation Basin Outer Basin Area (m^2)	3. Reservoir (m^2)	4. Other Facilities (m^2)	Total Area (m^2)	Required Land Area (m^2)	Basic Design Drawings Width/Length (m xm)	Basic Design Drawing
P1	A-1,200	Type A	44	83	100	500	749	2,244	47	
P2	A-2,000	Type A	102	118	167	500	915	2,525	50	
P3	A-2,800	Type A	184	155	233	500	1,105	2,834	53	Type A
P4	A-3,500	Type A	290	188	300	500	1,314	3,164	56	
P5	A-4,400	Type A	420	202	367	500	1,526	3,489	59	
P6	A-4,400	Type B	397	322	533	500	1,815	3,918	63	
P7	B-6,400	Type B	632	418	683	500	2,319	4,646	68	Type B
P8	C-40,000	Type C	3,080	1,958	2,000	1000	8,038	14,430	120	Type C

Attached Table 8.39 Typical Filtration Basin
(Filtration Speed Max.150m/day: Except 1stanby Basin and other 10% of standby capacity)

NO.	WTP Pattern Code	Type of WTP	Width	Length	Area of 1 Basin	Max. Filtration Speed	Capacity of 1 Basin	NO. of Basin	Total Filtration Area	Total Capacity (Q1)	Patterned Nominal Capacity (Except StandbyCapacity of 10%
			B	L	A			(Excluding 1 Standby Basin)			
			(m)	(m)	(m^2)	(m/day)	(m^3)		(m^2)	(m^3/day)	Q1x0.9
P1	A-1,200	Type A	1.5	2	3.00	150	450	4 (3)	9.0	1,350	1,215
P2	A-2,000	Type A	1.5	2	3.00	150	450	6 (5)	15.0	2,250	2,025
P3	A-2,800	Type A	1.5	2	3.00	150	450	8 (7)	21.0	3,150	2,835
P4	A-3,500	Type A	1.5	2	3.00	150	450	10 (9)	27.0	4,050	3,645
P5	A-4,400	Type A	1.5	2	3.00	150	450	12 (11)	33.0	4,950	4,455
P6	B-6,400	Type B	1.7	4	6.80	150	1020	8 (7)	47.6	7,140	6,426
P7	B-8,200	Type B	1.7	4	6.80	150	1020	10 (9)	61.2	9,180	8,262
P8	C-40,000	Type C	6.8	5	34.00	150	5100	10 (9)	306.0	45,900	41,310

Attached Table 8.40 Distribution Reservoir

NO.	WTP Pattern Code	Patterned Nominal Capacity	Reservoir (Retention time: 6Hours)	Area	Depth (D)
		(m^3/day)	(m^3)	(m^2)	(m)
P1	A-1,200	1,200	300	100	3.0
P2	A-2,000	2,000	500	167	3.0
P3	A-2,800	2,800	700	233	3.0
P4	A-3,500	3,600	900	300	3.0
P5	A-4,400	4,400	1,100	367	3.0
P6	B-6,400	6,400	1,600	533	3.0
P7	B-8,200	8,200	2,050	683	3.0
P8	C-40,000	40,000	10,000	2,000	5.0

Attached Table 8.41 Other facilities: Sand Settlement Basin

NO.	WTP Pattern Code	Patterned Nominal Capacity	No. of Basin	Size 0f 1 basin		Retention Time =15min
		(m^3/day)		B(m)	L(m)	
P1	A-1,200	1,200	2	1.0	3.0	
P2	A-2,000	2,000	2	1.0	3.0	
P3	A-2,800	2,800	2	1.5	5.0	
P4	A-3,500	3,500	2	1.5	5.0	
P5	A-4,400	4,300	2	1.5	5.0	
P6	B-6,400	6,400	2	2.0	6.0	
P7	B-8,200	8,200	2	2.0	7.0	
P8	C-40,000	40,000	2	5.0	15.0	

Attached Table 8.42 Other Facilities : Receiving Basin (Retention time 1.5min)

NO.	WTP Pattern Code	Nominal Capacity	Width	Length	No. of Basin	Depth	Volume	Retention time: 1.5min= 0.025hour
		(m^3/day)	B(m)	L(m)		D(m)	B*L*H	(hour)
P1	A-1,200	1,200	1	1	2	3	3	0.120
P2	A-2,000	2,000	1	1	2	3	3	0.072
P3	A-2,800	2,800	1	1	2	3	3	0.051
P4	A-3,500	3,500	1	1	2	3	3	0.041
P5	A-4,400	4,300	1	1	2	3	3	0.033
P6	B-6,400	6,400	1.5	1	2	3	4.5	0.034
P7	B-8,200	8,200	1.5	1	2	3	4.5	0.026
P8	C-40,000	40,000	3	3	2	3	27	0.032

3) Vakhsh Pipeline facilities

Renewal/Rehabilitation plan of a partial Vakhsh pipeline are shown as follows.

Table 8.1.17 Renewal Pipeline List

Pipe ID	Diameter (mm)	Length(m)	Total Renewal Length of Each Diameter (m)	Pipe Materials standard adopted for cost estimation
SBO1	1,200	1,229	1,229	Steel Pipe for Water Supply
V1+16++	900	25,769	25,769	Steel Pipe for Water Supply
16++V2	800	3,886	3,886	Steel Pipe for Water Supply
UJO9-5	700	852		
UJO9-6	700	825		
UJO9-7	700	1,030		
UJ10	700	156		
UJ11	700	36		
UJ12	700	22	2,921	Steel Pipe for Water Supply
V1+Va1+	614	440		
Va1+Va2+	614	21	461	Steel Pipe for Water Supply
US01	414	4,348		
US02	414	3,492		
V15	414	57		
V218	414	10,214	18,111	Steel Pipe for Water Supply
R15	234	409	409	Polyethylene Pipe for Water Supply
JO1	148	51		
R10	148	13		
R38	141	223	287	Polyethylene Pipe for Water Supply
R32	100	223		
R23	97	217	440	Polyethylene Pipe for Water Supply
V13	36	442	442	Polyethylene for Water Supply
Total			53,955	
Note: Steel Pipe for Water Supply: with coating and lining				

(2) Cost Estimation (Civil Work)

1) Procurement of main materials and equipment

The manufacturing products are imported from nearby countries of the Soviet years and other vicinal countries. The main importing countries of construction materials are shown as follows. However, days might be required to clear the customs, it is necessary to note it.

Table 8.1.18 Procurement of Main Materials and Equipment

Items	Contents
Tajikistan Domestic products	Reinforcing bar
The third country products	1. Steel Pipe and vinyl chloride pipe etc for Water Supply. Russia and other r vicinity countries. 2. Cement: Pakistan
Import route	The main import route to transport Japanese product is through China or through Russian Siberia railway. Transportation from third countries by road and railway can be available.

2) Design Criteria

Tajikistan Government adopts Design Criteria and Industrial Standard that Established in Soviet years presently. Therefore Tajikistan Government is programming to establish own Design Criteria and Industry Standard within this year (2008).

It might be noticed that though a lot of imported materials and equipment is distributed in the market, defective imported products are often seen in this country. To adopt adequate Design Criteria and industry standard is essential for this project.

Vakhsh Transmission main is passing through long distance in cotton field. As plastic pipe such as Polyethylene Pipe is seen getting damage while calibration by tractor and other works, pipe laying work shall be taken notice of protection of the pipeline such as pipe depth etc. even if the material of transmission main is steel.

3) Estimation of approximate implementation cost

In the rehabilitation and expansion plan for the Vakhsh Conduits, it is required to construct 15 water treatment facilities (capacity: 1,200～40,000 m3/day, total capacity: 93,000 m3/day), and partial replacement of existing pipe and installation of new pipelines (diameter: 125～1,200 mm, length: 61 km).

Required implementation cost is approximately 441 Million Somoni (130 Million US$, 13,900 Million Yen) as shown in *Table 8.1.19*.

Table 8.1.19 Approximate Implementation Cost

Item	Approximate Construction Cost		
	(Million Somoni)	(Million US$)	(Million Yen)
Construction of Water Treatment Facilities (15 sites) (Capacity: 93,000m3/day including 20% of Standby capacity)	222	65.4	7,000
Construction of Pipelines (diameter: 125～1,200mm, length: 61km)	127	37.4	4,000
Construction of Intake and Pumping Station(15 sites) (including electromechanic facilities)	63	18.7	2,000
Other Ancillary Facilities	29	8.4	900
Total	441	129.9	13,900

Note: 1Somoni=0.294 US$, 1US$=107Yen、1 Somoni=31.5Yen (July 2008)

8.1.6 PHASED IMPLEMENTATION PROGRAM

The Study Team proposed following implementation program on the Plan based on "8.1.4 Rehabilitation Plan, (2) Hydraulic Analysis of the Vakhsh Conduits Based on Water Demand Prediction and (4) Rehabilitation Plan"

However, it is necessary to conduct the water analysis of samples taken from several points on the Vakhsh Conduits. Sampling should be made at least one in a month throughout one year and all the samples should be analyzed on all the parameters stipulated in the Guidelines for Drinking-water Quality as much as possible and to study the necessity of the WTP. If the result of water analysis will show the necessity of WTP, the water treatment process should be determined and the effect of it should be confirmed through the operation of rather small scale pilot WTP. It is preferable to train the OM/M staffs of WTP in the pilot one.

Phase 1

1. Appropriate valves are installed to control the flow rate, which meets the maximum daily water demand of WSS, of the Vakhsh sub-mains which connect the Vakhsh main with the installation of WSS.
2. Area G is disconnected.
3. Improving the Sarband SB
4. Concrete pipe in the section between SB and HPS in the area A is renewed, D1200mm, L350m
5. WTP is constructed in the site of V15 of C area for 20 WSSs (B-04, B-01, B-06, B-10, B-11, B-12, B-13, B-14, B-19, B-20, B-21, B-22, V-11, V-12, V-14, B-03, B-17, B-25, V-13, V-15) and the neighboring areas without water supply service of them.
6. Conduits in the area H is replaced with SP-D426mm, L7.8km and the sub-mains to J12 and J13 are renewed with SP-D219mm, L1.3km and SP-D325mm, L1.7km respectively
7. WTP is constructed in the site of R15 of F area for three WSSs (R15, R19, R34) and the neighboring areas without water supply service of them.

8. Pipe R38 is replaced with HDPE-D160mm, L200m
9. Pipe V15 is replaced with SP-D426mm, L60m
10. Pipe B08 is replaced with HDPE-D125mm, L1.2km
11. Pipe B09 is replace with HDPE-D140mm, L1.0km
12. Pipe R15 is replaced with SP-D245mm, L400m

Phase 2
1. SP-D720mm, L3.2km is renewed in the B area from around 11km down from V1 (junction of the conduits in the A, B and C areas).

Phase 3
1. WTP is constructed in the vicinity of around 1km north to the Uzun PS in the B area for 11WSSs (R-02, R-03, R-12, R-13, R-14, R-23, R-25, R-28, R-35, R-36, R-39) and the neighboring areas without water supply service of them.
2. WTP is constructed in the vicinity of B05 of the C area for 8WSSs (B-02, B-05, B-08, B-09, B-18, B-23, B-15, B-16) and the neighboring areas without water supply service of them.

Phase 4
1. Conduit is doubled between SB and V1 by installing SP-D1020mm, L=7.7km.

Phase 5
1. WTP is constructed in the vicinity of Ko1 of E area for 7WSSs (R-11, R-33, R-10, R-27, R-16, R-18, R-29) and the neighboring areas without water supply service of them.
2. Conduit is doubled between V2 (junction of the conduits in the B, D and E areas) and V6 (junction of the conduits in the D and H areas) by installing SP-D426mm L=10.2km

Phase 6
1. The WSSs in the vicinity of and the WSS of Kolkhozabad; 7 WSSs in total (R-05, R-04, R-32, R-37, R-38, R-06, R-30), are disconnected

Phase 7
1. The conduit from V1 to V2 in the B area is doubled by installing SP-D720mm, L=25.4km
2. The conduit to the F area is now connected with the conduit from V2 to Dzhilikul in the D area. The junction is shifted from the said conduit in the D area to the newly installed conduit from V2 to V6.
3. The existing CIP-D600mm up to the WSS of B24, which is located the farthest from V1 in the C area, is replaced with SP-D630mm, L420m.
4. The conduit is doubled from V1 to the Junction to WSS of V15 in the C area by installing SP-D630mm, L460mm. The sub-main to V15 is changed it's connection to newly installed conduit.

Table 8.1.20 shows the yearly water demand and the capacity of Vakhsh Conduits according to the phased implementation program.

＜Alternative Plan＞

The Vakhsh Conduits will cover the seven (7) WSSs in Kolkhozobod Rayon Center and it's vicinity.

Phase 1 to 5 Same as the Plan mentioned above

Phase 6
1. The conduit from V1 to V2 in the B area is doubled by installing SP-D820mm, L=25.4km

2. The conduit to the F area is now connected with the conduit from V2 to Dzhilikul in the D area. The junction is shifted from the said conduit in the D area to the newly installed conduit from V2 to V6.
3. The existing CIP-D600mm up to the WSS of B24, which is located the farthest from V1 in the C area, is replaced with SP-D630mm, L420m.
4. The conduit is doubled from V1 to the Junction to WSS of V15 in the C area by installing SP-D630mm, L460mm. The sub-main to V15 is changed it's connection to newly installed conduit.

Table 8.1.21 shows the yearly water demand and the capacity of Vakhsh Conduits according to the phased implementation program on the alternative Plan.

Table 8.1.20 Stage Implementation Plan

year	Assumed actual maximun daily water demand on the Conduits (m^3/day)			Rehabilitation and Expansion Phase			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
	whole area	Area G is disconnected	Area G and WSSs in the vicinity of Kolkhozabad are disconnected	Tasks	Deadline of Construction	Capacity of the Conduits (m^3/day)	37,229	38,812	39,394	41,476	45,307	49,098	78,228
2007				Commencement of JICA Study									
2008				Rehabilitation Planning									
2009				Detailed Study and Planning									
2010				Detailed Planning and Design									
2011				Design and Construction									
2012					Design and Construction of WSSs for the areas where they do not exist	Phase 1	37,229						
2013	21,427	17,044	13,714				37,229						
2014	26,757	21,484	17,847				37,229						
2015	32,087	25,923	21,981				37,229						
2016	37,417	30,363	26,114				37,229						
2017	42,747	34,802	30,247			Phase 2 and 3	39,394						
2018	48,077	39,242	34,380			Phase 4 and 5	45,307						
2019	53,408	43,681	38,514				45,307						
2020	58,738	48,121	42,647			Phase 6	49,098						
2021	64,068	52,560	46,780			Phase 7	78,228						
2022	69,398	57,000	50,913				78,228						
2023	74,728	61,439	55,047				78,228						
2024	80,058	65,879	59,180				78,228						
2025	85,388	70,318	63,313				78,228						
2026	90,718	74,758	67,446				78,228						
2027	96,048	79,197	71,580				78,228						
2028	101,378	83,637	75,713				78,228						

Table 8.1.21 Stage Implementation Plan (Alternative)

year	Assumed actual maximun daily water demand on the Conduits (m^3/day)		Rehabilitation and Expansion Phase			Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 7
	whole area	Area G is disconnected	Tasks	Deadline of Construction	Capacity of the Conduits (m^3/day)	37,229	38,812	39,394	41,476	45,307	84,119
2007			Commencement of JICA Study								
2008			Rehabilitation Planning								
2009			Detailed Study and Planning								
2010			Detailed Planning and Design								
2011											
2012				Phase 1	37,229						
2013	21,427	17,044			37,229						
2014	26,710	21,484	Design and		37,229						
2015	31,993	25,923	Construction		37,229						
2016	37,276	30,363			37,229						
2017	42,559	34,802	Design and	Phase 2 and 3	39,394						
2018	47,841	39,242	Construction	Phase 4 and 5	45,307						
2019	53,124	43,681	of WSSs for	Phase 7	84,119						
2020	58,407	48,121	the areas		84,119						
2021	63,690	52,560	where they do		84,119						
2022	68,973	57,000	not exist		84,119						
2023	74,256	61,439			84,119						
2024	79,539	65,879			84,119						
2025	84,822	70,318			84,119						
2026	90,104	74,758			84,119						
2027	95,387	79,197			84,119						
2028	100,670	83,637			84,119						

8.2 REVIEW OF THE PLAN

This sub-chapter reviews the Rehabilitation Plan of Vakhsh Conduits under the Study in order to have clearer idea on detailed surveys and designs which will be implemented to materialize the Plan.

It is said that around 90% of the 800 thousand population in eight (8) Rayons of the southern region of the Khatlon Oblast where the Study covers lives and most of them are considered as poor. The water supply service, which is one of the basic utilities, is insufficient and existing water supply systems are deteriorating. The beneficiary population in Bokhtar, Vakhsh, Dzhilikul, Kolkhozobod and Kumsangir Rayons, who have the water supply service through the Vakhsh Conduits, is 298 thousand as of 2006. It is only 43.5% of the total population in the said five (5) Rayons.

Since the five (5) Rayons mentioned above have scarcely groundwater resources, most of the population in the Rayons depends on developed irrigation canals for its domestic water. This situation gives the population burdens of water fetching, limited water quantity for living, the danger of diseases related to water.

The rehabilitation plan prepared by the Study intends to renew or expand the existing Vakhsh conduits and to construct water treatment plants, if necessary in order to transmit water to existing or planned water supply systems. This scheme is supposed to enable to supply the population with drinking water which meets the forthcoming drinking water quality standards of Tajikistan through yard taps. This projected water supply facilities will be more convenient than fetching water from existing irrigation canals. Consequently, the realization of Plan will hopefully contribute to the poverty reduction, the public health, the rural development, etc.

Though, it has 30 years passed since the Vaksh conduits was constructed, the Plan will make use of the existing systems and facilities as long as possible except those which necessitates rehabilitation. Te double conduits of existing and projected pipelines will be able to meet the increased water demand in a future. It can be considered to be more economical than the change of all the conduits.

Since the steel pipe without internal coating, which, in general, generates rust-colored water due to incrustation of rust on the pipe inner wall, is used for the Vakhsh Conduits, the Plan locates projected water treatment plant in upstream area of the water supply systems and installs the high density polyethylene pipe, which does not have the danger of incrustation, for the distribution network of them.

The total construction cost of water treatment plants will be higher than that of integrated water treatment plant, however, it necessitates to replace all the existing pipes with new pipes with internal coating and hence the total project cost of the Plan will be far less than that of the rehabilitation plan to adopt the integrated water treatment plant.

The following is description of the Plan:

* Target Rayons: Bokhtar, Vakhsh, Dzhilikul, Kolkhozobod

* Target year:	2013	2028	25years
* Projected population to be served:	424,000	752,000	
* Service coverage (rural):	70% (2020: 90%)	90%	NDS, National water supply program
* Service coverage (Rayon Center):	97%	97%	ditto
* Projected rate of UFW:	50%	30%	
* Projected specific consumption:	20 lpcd	50 lpcd	
* Projected average daily conveyance of water:	25,800m^3/day	73,500m^3/day	

* Rehabilitation plan:

- Rehabilitation of existing conveyance conduits (ND20mm to 1020mm) 162.9km (to be abondoned: 45.3km, to be renewed: 17.2km, to be newly installed: 44.2km Total pipe length after rehabilitation: 179km）
- Construction of water treatment plant: 15 (1,200 – 40,000 m^3/day 93,300m^3/day in total)
- Renewal and new installation of ancillary facilities of the Conduits: valves, flow meters, water pipe bridge, etc.

The Study Team recommends reviewing the following points mentioned in "3.4 Underlying Difficulties in the Rehabilitation of the Vakhsh Conduits" in the implementation stage of the Plan and taking necessary measures to improve them.

(1) Collection of Data and Information Necessary for the OM/M
(2) Establishment of Quantitative Service Level Indicator
(3) Necessity of Water Quality Control
(4) Raising Population's Awareness of the Benefits of Water Supply and the Principle of "Beneficiary Payment"
(5) Establishment of Organization for OM/M of the WSSs
(6) Necessity of Drainage Facilities

As mentioned in "3.3.8 WSSs Connected to the Conduits", the number of existing WSSs which receive the water from the Vakhsh Conduits are 78 (the WSSs in Kumsangir Rayon are excluded) and a little less than 50% of them now stop their operation due to the deterioration or so. Even if 78 WSSs can operate, the total population served will be 349 thousand in 2028. It is accordingly necessary to construct WSSs for remaining 403 thousand population keeping pace with the progress of the Plan implementation.

The total cost to realize the Plan is estimated as about 441 million Tajikistan Somoni (US$ 130 million), the Study Team strongly recommends reviewing the construction plan of rural WSSs to be prepared in a near future as well as the rehabilitation Plan of the Vakhsh Conduits from the view points of the cost and financing.

Furthermore, it is necessary to prepare the detail layout of the Vakhsh Conduits which should have the attributed information such as repair records, specification of facilities, etc. by the implementation of detailed survey and design, to make out a topographic map of which scale is 1/5000, to analyze the raw water and to appraise the project considering the following points:

- Whether the target population wants to have water supply through the Vakhsh Conduits, or not? (Is the Vakhsh Conduits only the solution for the water supply in aforementioned four (4) Rayons?)
- Is the cost of water supply less than that from assumed alternative water sources such as groundwater, etc.?

Is it possible to include the OM/M cost of the Vakhsh Conduits into the water rate to be set for the WSSs connected/will be connected with the Vakhsh Conduits?

3 CHAPTER 8 REHABILITATION AND EXPANSION PLAN OF THE VAKHSH CONDUITS

Appendix Detail of Rehabilitation and extension Plan for the Vakhsh Conduits

（1）Attached Table

Attached Table 8.1 Population Projection of Sarband Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	19,500				
1	2002	20,300				
2	2003	21,200				
3	2004	21,800				
4	2005	22,900				
5	2006	23,400				
6	2007		24,300	13,800	13,800	10,500
7	2008		25,100		14,200	10,900
8	2009		25,900		14,700	11,200
9	2010		26,700		15,200	11,500
10	2011		27,500		15,700	11,800
11	2012		28,300		16,200	12,100
12	2013		29,100		16,700	12,400
13	2014		29,900		17,300	12,600
14	2015		30,700		17,800	12,900
15	2016		31,500		18,400	13,100
16	2017		32,300		19,000	13,300
17	2018		33,100		19,600	13,500
18	2019		33,900		20,300	13,600
19	2020		34,700		20,900	13,800
20	2021		35,500		21,600	13,900
21	2022		36,300		22,300	14,000
22	2023		37,100		23,000	14,100
23	2024		37,900		23,800	14,100
24	2025		38,700		24,600	14,100
25	2026		39,500		25,400	14,100
26	2027		40,300		26,200	14,100
27	2028		41,100		27,000	14,100

Applied population growth rate to the Rayon center is 3.3% Source: own study

Attached Table 8.2 Population Projection of Bokhtar Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	180,800				
1	2002	184,500				
2	2003	189,300				
3	2004	194,500				
4	2005	198,900				
5	2006	203,300				
6	2007		209,500	7,400	7,400	202,100
7	2008		214,900		7,600	207,300
8	2009		220,500		7,800	212,700
9	2010		226,100		8,100	218,000
10	2011		231,800		8,300	223,500
11	2012		237,600		8,500	229,100
12	2013		243,500		8,800	234,700
13	2014		249,400		9,000	240,400
14	2015		255,400		9,300	246,100
15	2016		261,400		9,500	251,900
16	2017		267,500		9,800	257,700
17	2018		273,700		10,100	263,600
18	2019		279,800		10,400	269,400
19	2020		286,100		10,700	275,400
20	2021		292,300		11,000	281,300
21	2022		298,700		11,300	287,400
22	2023		305,000		11,600	293,400
23	2024		311,400		12,000	299,400
24	2025		317,800		12,300	305,500
25	2026		324,300		12,700	311,600
26	2027		330,800		13,000	317,800
27	2028		337,300		13,400	323,900

Applied population growth rate to the Rayon center is 2.9% Source: own study

Attached Table 8.3 Population Projection of Vakhsh Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	130,800				
1	2002	133,100				
2	2003	135,800				
3	2004	138,600				
4	2005	141,300				
5	2006	144,400				
6	2007		147,400	12,400	12,400	135,000
7	2008		150,500		12,700	137,800
8	2009		153,600		13,000	140,600
9	2010		156,700		13,300	143,400
10	2011		159,900		13,600	146,300
11	2012		163,100		14,000	149,100
12	2013		166,400		14,300	152,100
13	2014		169,600		14,700	154,900
14	2015		172,900		15,000	157,900
15	2016		176,300		15,400	160,900
16	2017		179,600		15,800	163,800
17	2018		183,000		16,100	166,900
18	2019		186,400		16,500	169,900
19	2020		189,800		16,900	172,900
20	2021		193,200		17,300	175,900
21	2022		196,600		17,800	178,800
22	2023		200,100		18,200	181,900
23	2024		203,500		18,600	184,900
24	2025		207,000		19,100	187,900
25	2026		210,500		19,600	190,900
26	2027		214,100		20,000	194,100
27	2028		217,600		20,500	197,100

Applied population growth rate to the Rayon center is 2.4% Source: own study

Attached Table 8.4 Population Projection of Dzhilikul Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	77,200				
1	2002	79,000				
2	2003	81,100				
3	2004	83,100				
4	2005	85,200				
5	2006	87,300				
6	2007		89,600	13800	13,800	75,800
7	2008		91,800		14,200	77,600
8	2009		94,000		14,600	79,400
9	2010		96,300		15,000	81,300
10	2011		98,600		15,400	83,200
11	2012		100,800		15,800	85,000
12	2013		103,100		16,200	86,900
13	2014		105,500		16,600	88,900
14	2015		107,800		17,100	90,700
15	2016		110,100		17,600	92,500
16	2017		112,500		18,000	94,500
17	2018		114,900		18,500	96,400
18	2019		117,200		19,000	98,200
19	2020		119,600		19,500	100,100
20	2021		122,000		20,100	101,900
21	2022		124,400		20,600	103,800
22	2023		126,800		21,200	105,600
23	2024		129,200		21,700	107,500
24	2025		131,600		22,300	109,300
25	2026		134,100		22,900	111,200
26	2027		136,500		23,600	112,900
27	2028		139,000		24,200	114,800

Applied population growth rate to the Rayon center is 2.7% Source: own study

Attached Table 8.5 Population Projection of Kolkhozabod Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	132,400				
1	2002	135,200				
2	2003	138,600				
3	2004	142,500				
4	2005	145,200				
5	2006	148,600				
6	2007		152,700	13,000	13,000	139,700
7	2008		156,500		13,400	143,100
8	2009		160,300		13,700	146,600
9	2010		164,100		14,100	150,000
10	2011		168,000		14,500	153,500
11	2012		171,900		14,900	157,000
12	2013		175,800		15,300	160,500
13	2014		179,800		15,700	164,100
14	2015		183,800		16,100	167,700
15	2016		187,800		16,500	171,300
16	2017		191,900		17,000	174,900
17	2018		196,000		17,500	178,500
18	2019		200,100		17,900	182,200
19	2020		204,200		18,400	185,800
20	2021		208,300		18,900	189,400
21	2022		212,500		19,400	193,100
22	2023		216,700		20,000	196,700
23	2024		220,900		20,500	200,400
24	2025		225,100		21,000	204,100
25	2026		229,300		21,600	207,700
26	2027		233,500		22,200	211,300
27	2028		237,800		22,800	215,000

Applied population growth rate to the Rayon center is 2.7% Source: own study

Attached Table 8.6 Population Projection of Kumsangir Rayon

	year	Population in Rayon	Predicted Population in Rayon	Urban Poulation	Projected Urban Population	Projected Rural Population
0	2001	87,700				
1	2002	89,800				
2	2003	92,000				
3	2004	94,500				
4	2005	96,800				
5	2006	99,300				
6	2007		101,800	13000	13,000	88,800
7	2008		104,300		13,400	90,900
8	2009		106,800		13,700	93,100
9	2010		109,300		14,100	95,200
10	2011		111,900		14,500	97,400
11	2012		114,500		14,900	99,600
12	2013		117,100		15,300	101,800
13	2014		119,700		15,700	104,000
14	2015		122,300		16,100	106,200
15	2016		125,000		16,500	108,500
16	2017		127,600		17,000	110,600
17	2018		130,300		17,400	112,900
18	2019		133,000		17,900	115,100
19	2020		135,600		18,400	117,200
20	2021		138,300		18,900	119,400
21	2022		141,000		19,400	121,600
22	2023		143,700		19,900	123,800
23	2024		146,500		20,400	126,100
24	2025		149,200		21,000	128,200
25	2026		151,900		21,600	130,300
26	2027		154,600		22,100	132,500
27	2028		157,400		22,700	134,700

Applied population growth rate to the Rayon center is 2.7% Source: own study

Attached Table8.7 Population Projection of Kurgan Tyube

	year	Population in Kurgan	Predicted Population in Kurgan Tybe
0	2001	63,000	
1	2002	64,500	
2	2003	65,700	
3	2004	67,200	
4	2005	68,800	
5	2006	69,900	
6	2007		71,400
7	2008		72,800
8	2009		74,200
9	2010		75,600
10	2011		77,000
11	2012		78,400
12	2013		79,800
13	2014		81,200
14	2015		82,600
15	2016		84,000
16	2017		85,400
17	2018		86,800
18	2019		88,200
19	2020		89,600
20	2021		91,000
21	2022		92,400
22	2023		93,800
23	2024		95,200
24	2025		96,600
25	2026		98,000
26	2027		99,400
27	2028		100,800

Source: own study

Attached Table 8.8 Projected Water Demand of Sarband, Bokhtar, Vakhsh, Kolkhozabod, Dzhilikul and Kumsangir Rayons and Kurgan Tyube

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	55	58	61	64	66	68	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	89	92	94	96	96	96	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
basis of coverage					NDS					NDS					NWSP (only rural)								
events		JICA Study	JICA Study	Completion of JICA Study, Detailed Planning, Financing	Detailed Planning, Financing	Detailed Design, Construction	Detailed Design, Construction	inauguration															
assumed rate of UFW	%							50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
rural population		651,900	667,600	683,600	699,400	715,700	731,900	748,400	764,900	781,500	798,200	814,800	831,800	848,400	865,200	881,800	898,700	915,500	932,400	949,100	965,800	982,700	999,600
Bokhtar		202,100	207,300	212,700	218,000	223,500	229,100	234,700	240,400	246,100	251,900	257,700	263,600	269,400	275,400	281,300	287,400	293,400	299,400	305,500	311,600	317,800	323,900
Sarband		10,500	10,900	11,200	11,500	11,800	12,100	12,400	12,600	12,900	13,100	13,300	13,500	13,600	13,800	13,900	14,000	14,100	14,100	14,100	14,100	14,100	14,100
Vakhsh		135,000	137,800	140,600	143,400	146,300	149,100	152,100	154,900	157,900	160,900	163,800	166,900	169,900	172,900	175,900	178,800	181,900	184,900	187,900	190,900	194,100	197,100
Kolkhozabod		139,700	143,100	146,600	150,000	153,500	157,000	160,500	164,100	167,700	171,300	174,900	178,500	182,200	185,800	189,400	193,100	196,700	200,400	204,100	207,700	211,300	215,000
Dzhilikul		75,800	77,600	79,400	81,300	83,200	85,000	86,900	88,900	90,700	92,500	94,500	96,400	98,200	100,100	101,900	103,800	105,600	107,500	109,300	111,200	112,900	114,800
Kumsangir		88,800	90,900	93,100	95,200	97,400	99,600	101,800	104,000	106,200	108,500	110,600	112,900	115,100	117,200	119,400	121,600	123,800	126,100	128,200	130,300	132,500	134,700
rural population will be served								523,900	550,700	578,300	614,600	651,800	690,400	729,600	778,700	793,600	808,800	824,000	839,200	854,200	869,200	884,400	899,600
liter par capita per day	liter							20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
domestic use	m^3/day							10,478	12,115	13,879	15,980	18,250	20,712	23,347	26,476	28,570	30,734	32,960	35,246	37,585	39,983	42,451	44,980
industrial use (2% of domestic use)	m^3/day							210	242	278	320	365	414	467	530	571	615	659	705	752	800	849	900
commercial use (2% of domestic use)	m^3/day							210	242	278	320	365	414	467	530	571	615	659	705	752	800	849	900
Institutional use (2% of domestic use)	m^3/day							210	242	278	320	365	414	467	530	571	615	659	705	752	800	849	900
sub-total	m^3/day							11,108	12,841	14,713	16,940	19,345	21,954	24,748	28,066	30,283	32,579	34,937	37,361	39,841	42,383	44,998	47,680
UFW	m^3/day							11,108	12,191	13,206	14,430	15,637	16,766	17,921	19,263	19,606	19,968	20,256	20,384	20,524	20,593	20,501	20,434
sub-total	m^3/day							22,216	25,032	27,919	31,370	34,982	38,720	42,669	47,329	49,889	52,547	55,193	57,745	60,365	62,976	65,499	68,114
water use of WSS (5% of above)	m^3/day							1,111	1,252	1,396	1,568	1,749	1,936	2,133	2,366	2,494	2,627	2,760	2,887	3,018	3,149	3,275	3,406
rural water demand	m^3/day							23,327	26,284	29,315	32,938	36,731	40,656	44,802	49,695	52,383	55,174	57,953	60,632	63,383	66,125	68,774	71,520
urban population		73,400	75,500	77,500	79,800	82,000	84,300	86,600	89,000	91,400	93,900	96,600	99,200	102,000	104,800	107,800	110,800	113,900	117,000	120,300	123,800	127,100	130,600
Bokhtar		7,400	7,600	7,800	8,100	8,300	8,500	8,800	9,000	9,300	9,500	9,800	10,100	10,400	10,700	11,000	11,300	11,600	12,000	12,300	12,700	13,000	13,400
Sarband		13,800	14,200	14,700	15,200	15,700	16,200	16,700	17,300	17,800	18,400	19,000	19,600	20,300	20,900	21,600	22,300	23,000	23,800	24,600	25,400	26,200	27,000
Vakhsh		12,400	12,700	13,000	13,300	13,600	14,000	14,300	14,700	15,000	15,400	15,800	16,100	16,500	16,900	17,300	17,800	18,200	18,600	19,100	19,600	20,000	20,500
Kolkhozabod		13,000	13,400	13,700	14,100	14,500	14,900	15,300	15,700	16,100	16,500	17,000	17,500	17,900	18,400	18,900	19,400	20,000	20,500	21,000	21,600	22,200	22,800
Dzhilikul		13,800	14,200	14,600	15,000	15,400	15,800	16,200	16,600	17,100	17,600	18,000	18,500	19,000	19,500	20,100	20,600	21,200	21,700	22,300	22,900	23,600	24,200
Kumsangir		13,000	13,400	13,700	14,100	14,500	14,900	15,300	15,700	16,100	16,500	17,000	17,400	17,900	18,400	18,900	19,400	19,900	20,400	21,000	21,600	22,100	22,700
urban population will be served								84,000	86,300	88,700	91,100	93,700	96,200	98,900	101,700	104,600	107,500	110,500	113,500	116,700	120,100	123,300	126,700
liter par capita per day	liter							50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100
domestic use	m^3/day							4,200	4,574	5,056	5,466	5,903	6,445	6,923	7,424	8,054	8,600	9,172	9,875	10,503	11,169	11,960	12,670
industrial use (5% of domestic use)	m^3/day							210	229	253	273	295	322	346	371	403	430	459	494	525	558	598	634
commercial use (5% of domestic use)	m^3/day							210	229	253	273	295	322	346	371	403	430	459	494	525	558	598	634
Institutional use (5% of domestic use)	m^3/day							210	229	253	273	295	322	346	371	403	430	459	494	525	558	598	634
sub-total	m^3/day							4,830	5,261	5,815	6,285	6,788	7,411	7,961	8,537	9,263	9,890	10,549	11,357	12,078	12,843	13,754	14,572
UFW	m^3/day							4,830	4,994	5,219	5,354	5,487	5,660	5,765	5,859	5,997	6,062	6,116	6,196	6,222	6,240	6,266	6,245
sub-total	m^3/day							9,660	10,255	11,034	11,639	12,275	13,071	13,726	14,396	15,260	15,952	16,665	17,553	18,300	19,083	20,020	20,817
water use of WSS (5% of above)	m^3/day							483	513	552	582	614	654	686	720	763	798	833	878	915	954	1,001	1,041
urban water demand	m^3/day							10,143	10,768	11,586	12,221	12,889	13,725	14,412	15,116	16,023	16,750	17,498	18,431	19,215	20,037	21,021	21,858
total of urban and rural	m^3/day							33,470	37,052	40,901	45,159	49,620	54,381	59,214	64,811	68,406	71,924	75,451	79,063	82,598	86,162	89,795	93,378
Kurgan Tyube		71,400	72,800	74,200	75,600	77,000	78,400	79,800	81,200	82,600	84,000	85,400	86,800	88,200	89,600	91,000	92,400	93,800	95,200	96,600	98,000	99,400	100,800
Kurgan Tyube population will be served								77,400	78,800	80,100	81,500	82,800	84,200	85,600	86,900	88,300	89,600	91,000	92,300	93,700	95,100	96,400	97,800
liter par capita per day	liter							100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130
domestic use	m^3/day							7,740	8,038	8,330	8,639	8,942	9,262	9,587	9,907	10,243	10,573	10,920	11,261	11,619	11,983	12,339	12,714
industrial use (20% of domestic use)	m^3/day							1,548	1,608	1,666	1,728	1,788	1,852	1,917	1,981	2,049	2,115	2,184	2,252	2,324	2,397	2,468	2,543
commercial use (20% of domestic use)	m^3/day							1,548	1,608	1,666	1,728	1,788	1,852	1,917	1,981	2,049	2,115	2,184	2,252	2,324	2,397	2,468	2,543
Institutional use (20% of domestic use)	m^3/day							1,548	1,608	1,666	1,728	1,788	1,852	1,917	1,981	2,049	2,115	2,184	2,252	2,324	2,397	2,468	2,543
sub-total	m^3/day							12,384	12,862	13,328	13,823	14,306	14,818	15,338	15,850	16,390	16,918	17,472	18,017	18,591	19,174	19,743	20,343
UFW	m^3/day							12,384	12,210	11,962	11,775	11,564	11,316	11,107	10,878	10,612	10,369	10,130	9,830	9,577	9,316	8,995	8,718
sub-total	m^3/day							24,768	25,072	25,290	25,598	25,870	26,134	26,445	26,728	27,002	27,287	27,602	27,847	28,168	28,490	28,738	29,061
water use of WSS (5% of above)	m^3/day							1,238	1,254	1,265	1,280	1,294	1,307	1,322	1,336	1,350	1,364	1,380	1,392	1,408	1,425	1,437	1,453
Kurgan Tyube water demand	m^3/day							26,006	26,326	26,555	26,878	27,164	27,441	27,767	28,064	28,352	28,651	28,982	29,239	29,576	29,915	30,175	30,514
Total Water Demand	m^3/day							59,476	63,378	67,456	72,037	76,784	81,822	86,981	92,875	96,758	100,575	104,433	108,302	112,174	116,077	119,970	123,892

Attached Table 8.9 Projected Water Demand of Vakhsh Rayon

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
basis of coverage				NDS					NWSP (only rural)								
assumed rate of UFW	%	50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
Vakhsh Rural																	
rural population		152,100	154,900	157,900	160,900	163,800	166,900	169,900	172,900	175,900	178,800	181,900	184,900	187,900	190,900	194,100	197,100
rural population will be served		106,500	111,500	116,800	123,900	131,000	138,500	146,100	155,600	158,300	160,900	163,700	166,400	169,100	171,800	174,700	177,400
liter par capita per day	liter	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
domestic use	m^3/day	2,130	2,453	2,803	3,221	3,668	4,155	4,675	5,290	5,699	6,114	6,548	6,989	7,440	7,903	8,386	8,870
industrial use (2% of domestic use)	m^3/day	43	49	56	64	73	83	94	106	114	122	131	140	149	158	168	177
commercial use (2% of domestic use)	m^3/day	43	49	56	64	73	83	94	106	114	122	131	140	149	158	168	177
Institutional use (2% of domestic use)	m^3/day	43	49	56	64	73	83	94	106	114	122	131	140	149	158	168	177
sub-total	m^3/day	2,259	2,600	2,971	3,413	3,887	4,404	4,957	5,608	6,041	6,480	6,941	7,409	7,887	8,377	8,890	9,401
UFW	m^3/day	2,259	2,468	2,667	2,908	3,142	3,363	3,590	3,849	3,911	3,972	4,024	4,042	4,063	4,070	4,050	4,029
sub-total	m^3/day	4,518	5,068	5,638	6,321	7,029	7,767	8,547	9,457	9,952	10,452	10,965	11,451	11,950	12,447	12,940	13,430
water use of WSS (5% of above)	m^3/day	226	253	282	316	351	388	427	473	498	523	548	573	598	622	647	672
rural water demand	m^3/day	4,744	5,321	5,920	6,637	7,380	8,155	8,974	9,930	10,450	10,975	11,513	12,024	12,548	13,069	13,587	14,102
Vakhsh Rayon Center																	
urban population		14,300	14,700	15,000	15,400	15,800	16,100	16,500	16,900	17,300	17,800	18,200	18,600	19,100	19,600	20,000	20,500
urban population will be served		13,900	14,300	14,600	14,900	15,300	15,600	16,000	16,400	16,800	17,300	17,700	18,000	18,500	19,000	19,400	19,900
liter par capita per day	liter	50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100
domestic use	m^3/day	695	758	832	894	964	1,045	1,120	1,197	1,294	1,384	1,469	1,566	1,665	1,767	1,882	1,990
industrial use (5% of domestic use)	m^3/day	35	38	42	45	48	52	56	60	65	69	73	78	83	88	94	100
commercial use (5% of domestic use)	m^3/day	35	38	42	45	48	52	56	60	65	69	73	78	83	88	94	100
Institutional use (5% of domestic use)	m^3/day	35	38	42	45	48	52	56	60	65	69	73	78	83	88	94	100
sub-total	m^3/day	800	872	958	1,029	1,108	1,201	1,288	1,377	1,489	1,591	1,688	1,800	1,914	2,031	2,164	2,290
UFW	m^3/day	800	828	860	877	896	917	933	945	964	975	979	982	986	987	986	981
sub-total	m^3/day	1,600	1,700	1,818	1,906	2,004	2,118	2,221	2,322	2,453	2,566	2,667	2,782	2,900	3,018	3,150	3,271
water use of WSS (5% of above)	m^3/day	80	85	91	95	100	106	111	116	123	128	133	139	145	151	157	164
urban water demand	m^3/day	1,680	1,785	1,909	2,001	2,104	2,224	2,332	2,438	2,576	2,694	2,800	2,921	3,045	3,169	3,307	3,435
Vakhsh total water demand	m^3/day	6,424	7,106	7,829	8,638	9,484	10,379	11,306	12,368	13,026	13,669	14,313	14,945	15,593	16,238	16,894	17,537
Projected Water Demand (deduction)	m^3/day	2,846	3,193	3,552	3,982	4,428	4,893	5,385	5,958	6,270	6,585	6,908	7,214	7,529	7,841	8,152	8,461
Bokhtar rural water demand for Vakhsh	m^3/day	1,898	2,128	2,368	2,655	2,952	3,262	3,589	3,972	4,180	4,390	4,605	4,810	5,019	5,228	5,435	5,641
Bokhtar water demand by existing WSSs.	m^3/day	949	1,042	1,115	1,208	1,301	1,370	1,462	1,554	1,619	1,710	1,801	1,863	1,953	2,044	2,106	2,196

Attached Table 8.10 Projected Water Demand of Dzhilikul Rayon

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
basis of coverage				NDS					NWSP (only rural)								
assumed rate of UFW	%	50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
Dzhilikul Rural																	
rural population		86,900	88,900	90,700	92,500	94,500	96,400	98,200	100,100	101,900	103,800	105,600	107,500	109,300	111,200	112,900	114,800
rural population will be served		60,800	64,000	67,100	71,200	75,600	80,000	84,500	90,100	91,700	93,400	95,000	96,800	98,400	100,100	101,600	103,300
liter par capita per day	liter	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
domestic use	m^3/day	1,216	1,408	1,610	1,851	2,117	2,400	2,704	3,063	3,301	3,549	3,800	4,066	4,330	4,605	4,877	5,165
industrial use (2% of domestic use)	m^3/day	24	28	32	37	42	48	54	61	66	71	76	81	87	92	98	103
commercial use (2% of domestic use)	m^3/day	24	28	32	37	42	48	54	61	66	71	76	81	87	92	98	103
Institutional use (2% of domestic use)	m^3/day	24	28	32	37	42	48	54	61	66	71	76	81	87	92	98	103
sub-total	m^3/day	1,288	1,492	1,706	1,962	2,243	2,544	2,866	3,246	3,499	3,762	4,028	4,309	4,591	4,881	5,171	5,474
UFW	m^3/day	1,288	1,416	1,531	1,671	1,813	1,943	2,075	2,228	2,265	2,306	2,335	2,351	2,365	2,372	2,356	2,346
sub-total	m^3/day	2,576	2,908	3,237	3,633	4,056	4,487	4,941	5,474	5,764	6,068	6,363	6,660	6,956	7,253	7,527	7,820
water use of WSS (5% of above)	m^3/day	129	145	162	182	203	224	247	274	288	303	318	333	348	363	376	391
rural water demand	m^3/day	2,705	3,053	3,399	3,815	4,259	4,711	5,188	5,748	6,052	6,371	6,681	6,993	7,304	7,616	7,903	8,211
Dzhilikul Rayon Center																	
urban population		16,200	16,600	17,100	17,600	18,000	18,500	19,000	19,500	20,100	20,600	21,200	21,700	22,300	22,900	23,600	24,200
urban population will be served		15,700	16,100	16,600	17,100	17,500	17,900	18,400	18,900	19,500	20,000	20,600	21,000	21,600	22,200	22,900	23,500
liter par capita per day	liter	50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100
domestic use	m^3/day	785	853	946	1,026	1,103	1,199	1,288	1,380	1,502	1,600	1,710	1,827	1,944	2,065	2,221	2,350
industrial use (5% of domestic use)	m^3/day	39	43	47	51	55	60	64	69	75	80	86	91	97	103	111	118
commercial use (5% of domestic use)	m^3/day	39	43	47	51	55	60	64	69	75	80	86	91	97	103	111	118
Institutional use (5% of domestic use)	m^3/day	39	43	47	51	55	60	64	69	75	80	86	91	97	103	111	118
sub-total	m^3/day	902	982	1,087	1,179	1,268	1,379	1,480	1,587	1,727	1,840	1,968	2,100	2,235	2,374	2,554	2,704
UFW	m^3/day	902	932	976	1,004	1,025	1,053	1,072	1,089	1,118	1,128	1,141	1,146	1,151	1,153	1,164	1,159
sub-total	m^3/day	1,804	1,914	2,063	2,183	2,293	2,432	2,552	2,676	2,845	2,968	3,109	3,246	3,386	3,527	3,718	3,863
water use of WSS (5% of above)	m^3/day	90	96	103	109	115	122	128	134	142	148	155	162	169	176	186	193
urban water demand	m^3/day	1,894	2,010	2,166	2,292	2,408	2,554	2,680	2,810	2,987	3,116	3,264	3,408	3,555	3,703	3,904	4,056
Dzhilikul total water demand	m^3/day	4,599	5,064	5,565	6,108	6,667	7,265	7,868	8,558	9,040	9,486	9,945	10,401	10,859	11,319	11,807	12,267
Jillikul rural water demand for Vakhsh C	m^3/day	2,705	3,053	3,399	3,815	4,259	4,711	5,188	5,748	6,052	6,371	6,681	6,993	7,304	7,616	7,903	8,211
Jillikul water demand by existing WSSs.	m^3/day	1,408	1,554	1,665	1,805	1,949	2,055	2,195	2,337	2,436	2,579	2,715	2,814	2,952	3,094	3,181	3,323

Attached Table 8.11 Projected Water Demand of Kolkhozobod Rayon

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
basis of coverage				NDS					NWSP (only rural)								
assumed rate of UFW	%	50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
Kolkozabod Rural																	
rural population		160,500	164,100	167,700	171,300	174,900	178,500	182,200	185,800	189,400	193,100	196,700	200,400	204,100	207,700	211,300	215,000
rural population will be served		112,400	118,200	124,100	131,900	139,900	148,200	156,700	167,200	170,500	173,800	177,000	180,400	183,700	186,900	190,200	193,500
liter par capita per day	liter	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
domestic use	m^3/day	2,248	2,600	2,978	3,429	3,917	4,446	5,014	5,685	6,138	6,604	7,080	7,577	8,083	8,597	9,130	9,675
industrial use (2% of domestic use)	m^3/day	45	52	60	69	78	89	100	114	123	132	142	152	162	172	183	194
commercial use (2% of domestic use)	m^3/day	45	52	60	69	78	89	100	114	123	132	142	152	162	172	183	194
Institutional use (2% of domestic use)	m^3/day	45	52	60	69	78	89	100	114	123	132	142	152	162	172	183	194
sub-total	m^3/day	2,383	2,756	3,158	3,636	4,151	4,713	5,314	6,027	6,507	7,000	7,506	8,033	8,569	9,113	9,679	10,257
UFW	m^3/day	2,383	2,616	2,834	3,097	3,355	3,599	3,848	4,137	4,213	4,290	4,352	4,383	4,414	4,428	4,410	4,396
sub-total	m^3/day	4,766	5,372	5,992	6,733	7,506	8,312	9,162	10,164	10,720	11,290	11,858	12,416	12,983	13,541	14,089	14,653
water use of WSS (5% of above)	m^3/day	238	269	300	337	375	416	458	508	536	565	593	621	649	677	704	733
rural water demand	m^3/day	5,004	5,641	6,292	7,070	7,881	8,728	9,620	10,672	11,256	11,855	12,451	13,037	13,632	14,218	14,793	15,386
Kolkhozabod Rayon Center																	
urban population		15,300	15,700	16,100	16,500	17,000	17,500	17,900	18,400	18,900	19,400	20,000	20,500	21,000	21,600	22,200	22,800
urban population will be served		14,800	15,200	15,600	16,000	16,500	17,000	17,400	17,800	18,300	18,800	19,400	19,900	20,400	21,000	21,500	22,100
liter par capita per day	liter	50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100
domestic use	m^3/day	740	806	889	960	1,040	1,139	1,218	1,299	1,409	1,504	1,610	1,731	1,836	1,953	2,086	2,210
industrial use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	81	87	92	98	104	111
commercial use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	81	87	92	98	104	111
Institutional use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	81	87	92	98	104	111
sub-total	m^3/day	851	926	1,021	1,104	1,196	1,310	1,401	1,494	1,619	1,729	1,853	1,992	2,112	2,247	2,398	2,543
UFW	m^3/day	851	879	916	940	967	1,000	1,015	1,025	1,048	1,060	1,074	1,087	1,088	1,092	1,093	1,090
sub-total	m^3/day	1,702	1,805	1,937	2,044	2,163	2,310	2,416	2,519	2,667	2,789	2,927	3,079	3,200	3,339	3,491	3,633
water use of WSS (5% of above)	m^3/day	85	90	97	102	108	116	121	126	133	139	146	154	160	167	175	182
urban water demand	m^3/day	1,787	1,895	2,034	2,146	2,271	2,426	2,537	2,645	2,800	2,928	3,073	3,233	3,360	3,506	3,666	3,815
Kolkhzabod total water demand	m^3/day	6,791	7,536	8,327	9,217	10,152	11,155	12,157	13,317	14,056	14,783	15,524	16,270	16,992	17,724	18,458	19,201
Projected Water Demand (deduction)	m^3/day	601	678	755	852	947	1,048	1,154	1,283	1,346	1,426	1,491	1,568	1,640	1,704	1,781	1,845
Kolkhozabad rural water demand for Vak	m^3/day	4,403	4,964	5,537	6,218	6,935	7,680	8,466	9,389	9,909	10,429	10,960	11,469	11,993	12,514	13,012	13,541
Kolkhozabad water demand by existing W	m^3/day	3,586	3,954	4,242	4,608	4,976	5,247	5,615	5,983	6,245	6,614	6,978	7,234	7,602	7,967	8,212	8,575

Attached Table 8.12 Projected Water Demand of Kumsangir Rayon

		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
rural water supply coverage	%	70	72	74	77	80	83	86	90	90	90	90	90	90	90	90	90
urban water supply coverage	%	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
basis of coverage				NDS					NWSP (only rural)								
assumed rate of UFW	%	50	49	47	46	45	43	42	41	39	38	37	35	34	33	31	30
Kumsangir Rural																	
rural population		101,800	104,000	106,200	108,500	110,600	112,900	115,100	117,200	119,400	121,600	123,800	126,100	128,200	130,300	132,500	134,700
rural population will be served		71,300	74,900	78,600	83,500	88,500	93,700	99,000	105,500	107,500	109,400	111,400	113,500	115,400	117,300	119,300	121,200
liter par capita per day	liter	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
domestic use	m^3/day	1,426	1,648	1,886	2,171	2,478	2,811	3,168	3,587	3,870	4,157	4,456	4,767	5,078	5,396	5,726	6,060
industrial use (2% of domestic use)	m^3/day	29	33	38	43	50	56	63	72	77	83	89	95	102	108	115	121
commercial use (2% of domestic use)	m^3/day	29	33	38	43	50	56	63	72	77	83	89	95	102	108	115	121
Institutional use (2% of domestic use)	m^3/day	29	33	38	43	50	56	63	72	77	83	89	95	102	108	115	121
sub-total	m^3/day	1,513	1,747	2,000	2,300	2,628	2,979	3,357	3,803	4,101	4,406	4,723	5,052	5,384	5,720	6,071	6,423
UFW	m^3/day	1,513	1,658	1,795	1,959	2,124	2,275	2,431	2,610	2,655	2,700	2,738	2,756	2,774	2,779	2,766	2,753
sub-total	m^3/day	3,026	3,405	3,795	4,259	4,752	5,254	5,788	6,413	6,756	7,106	7,461	7,808	8,158	8,499	8,837	9,176
water use of WSS (5% of above)	m^3/day	151	170	190	213	238	263	289	321	338	355	373	390	408	425	442	459
rural water demand	m^3/day	3,177	3,575	3,985	4,472	4,990	5,517	6,077	6,734	7,094	7,461	7,834	8,198	8,566	8,924	9,279	9,635
Kumsangir Rayon Center																	
urban population		15,300	15,700	16,100	16,500	17,000	17,400	17,900	18,400	18,900	19,400	19,900	20,400	21,000	21,600	22,100	22,700
urban population will be served		14,800	15,200	15,600	16,000	16,500	16,900	17,400	17,800	18,300	18,800	19,300	19,800	20,400	21,000	21,400	22,000
liter par capita per day	liter	50	53	57	60	63	67	70	73	77	80	83	87	90	93	97	100
domestic use	m^3/day	740	806	889	960	1,040	1,132	1,218	1,299	1,409	1,504	1,602	1,723	1,836	1,953	2,076	2,200
industrial use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	80	86	92	98	104	110
commercial use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	80	86	92	98	104	110
Institutional use (5% of domestic use)	m^3/day	37	40	44	48	52	57	61	65	70	75	80	86	92	98	104	110
sub-total	m^3/day	851	926	1,021	1,104	1,196	1,303	1,401	1,494	1,619	1,729	1,842	1,981	2,112	2,247	2,388	2,530
UFW	m^3/day	851	879	916	940	967	995	1,015	1,025	1,048	1,060	1,068	1,081	1,088	1,092	1,088	1,084
sub-total	m^3/day	1,702	1,805	1,937	2,044	2,163	2,298	2,416	2,519	2,667	2,789	2,910	3,062	3,200	3,339	3,476	3,614
water use of WSS (5% of above)	m^3/day	85	90	97	102	108	115	121	126	133	139	145	153	160	167	174	181
urban water demand	m^3/day	1,787	1,895	2,034	2,146	2,271	2,413	2,537	2,645	2,800	2,928	3,055	3,215	3,360	3,506	3,650	3,795
Kumsangir total water demand	m^3/day	4,964	5,471	6,019	6,619	7,261	7,930	8,613	9,380	9,894	10,389	10,889	11,413	11,926	12,430	12,929	13,430
Projected Water Demand (deduction)	m^3/day	205	234	258	295	327	359	399	440	468	498	521	549	571	593	622	644
Kumsangir rural water demand on Vakhs	m^3/day	2,972	3,342	3,727	4,178	4,663	5,158	5,678	6,294	6,626	6,963	7,314	7,649	7,994	8,331	8,656	8,990
Kumsangir water demand by existing WS	m^3/day	1,334	1,469	1,575	1,711	1,844	1,946	2,079	2,212	2,308	2,441	2,574	2,668	2,798	2,930	3,019	3,151

Attached Table 8.13 The Maximum Daily Water Demand of Each Water Supply Systems and Water Demands to be Loaded on the Vakhsh Conduits for theAnalysis

Area	IDNo	LPCD2028	total 2028	Area	IDNo	LPCD2028	total 2028
E	R-01	5.13	8.11	B	R-14	4.68	7.39
E (RC)	**R-05vc**	59.12	59.12	B	R-23	1.75	2.77
E	R-04v	5.75	9.09	B	R-25	3.28	5.18
E	R-32v	3.7	5.85	B	R-28	10.45	16.51
E	R-37v	5.75	9.09	B	R-35	3.76	5.94
E	R-38vc	5.75	9.09	B	R-36	7.59	11.99
E	R-06v	3.7	5.85	B	R-39	1.54	2.43
E	R-30v	2.26	3.57	C	B-24	11.96	65.18
C	B-02	0.68	3.71	C (RC)	B-07v	34.78	34.78
C	B-05	0.86	4.69	D	J-02v	0.91	2.25
C	B-08	1.06	5.78	D	J-11v	3.44	8.5
C	B-09	1.24	6.76	D (RC)	J-09v	68.03	68.03
C	B-18	0.86	4.69	F	R-15	5.13	8.11
C	B-23	0.65	3.54	F	R-19vc	7.18	11.34
C	B-15	0.06	0.33	F	R-34vc	3.44	5.44
C	B-16	0.03	0.16	F	R-07	6.57	10.38
D	J-01	2.3	5.68	F	R-26	6.45	10.19
D	J-05	3.72	9.19	G	Q-03	2.53	7.21
D	J-07	3.83	9.46	G	Q-04	21.24	60.53
D	J-06	1.35	3.33	G	Q-05	15.89	45.29
E	R-11	8.46	13.37	G	Q-06	3.1	8.84
E	R-33	2.26	3.57	G	R-09	5.86	9.26
E	R-10	2.48	3.92	G	Q-02	2.26	6.44
E	R-27	2.47	3.9	G	Q-07	3.54	10.09
E	R-16	1.22	1.93	G (RC)	Q-01vc	58.85	58.85
E	R-18	3.43	5.42	H	J-12	7.69	18.99
E	R-29	9.99	15.78	H	J-13	18.3	45.2
D	J-03	1.15	2.84	H	J-08	8.5	21
D	J-04	1.35	3.33	H	J-10v	1.74	4.3
D	R-24	2.67	4.22			566.79	1170.47
A	B-04	0.81	4.41				
B	B-01	0.22	1.2				
B	B-06	0.03	0.16				
B	B-10	1.6	8.72				
B	B-11	0.86	4.69				
B	B-12	2.25	12.26				
B	B-13	1.28	6.98				
B	B-14	3.21	17.49				
B	B-19	1.71	9.32				
B	B-20	19.12	104.2				
B	B-21	0.43	2.34				
B	B-22	0.17	0.93				
B	V-11	1.37	3.52				
B	V-12	0.39	1				
B	V-14	0.49	1.26				
C	B-03	0.1	0.55				
C	B-17	0.02	0.11				
C	B-25	18.16	98.97				
C	V-15	30.14	77.46				
C	V-13	0.2	0.51				
B	R-02	2.67	4.22				
B	R-03	3.7	5.85				
B	R-12	2.67	4.22				
B	R-13	1.47	2.32				

Attached Table 8.14 LIST of Projected WTPs

ID No	Maximum Daily Water Demand in 2028 (m^3/day)			ID No	Maximum Daily Water Demand in 2028 (m^3/day)		
	Existing WSSs	Un-Supplied Areas	Total		Existing WSSs	Un-Supplied Areas	Total
WTP R-01	**443**	**288**	**731**	R-02	231	150	381
J-01	199	240	439	R-03	320	208	528
J-05	321	389	710	R-12	231	150	381
J-07	331	400	731	R-13	127	83	210
J-06	117	140	257	R-14	404	263	667
J-02v	79	95	174	R-23	151	99	250
J-11v	297	360	657	R-25	283	184	467
WTP J-01	**1344**	**1624**	**2968**	R-28	903	587	1490
R-11	731	475	1206	R-35	325	211	536
R-10	214	139	353	R-36	656	426	1082
R-27	213	140	353	R-39	133	86	219
R-16	105	69	174	**WTP R-12**	**3764**	**2447**	**6210**
R-18	296	193	489	R-15	443	288	731
R-29	863	561	1424	R-19	620	404	1024
R-33	195	113	308	R-34	297	194	491
WTP Ko1	**2617**	**1690**	**4307**	**WTP R-15**	**1360**	**886**	**2246**
J-03	99	120	219	R-07	568	369	937
J-04	117	140	257	R-26	557	362	919
R-24	231	150	381	**WTP R-07**	**1125**	**731**	**1856**
WTP R-24	**447**	**410**	**857**	**WTP Q-04**	**1835**	**3395**	**5230**
B-04	70	311	381	**WTP Q-05**	**1373**	**2540**	**3913**
B-01	19	85	104	Q-06	268	496	764
B-06	3	11	14	R-09	506	329	835
B-10	138	615	753	**WTP Q06**	**774**	**825**	**1599**
B-11	74	331	405	Q-02	195	361	556
B-12	194	865	1059	Q-07	306	566	872
B-13	111	492	603	**WTP Q-02**	**501**	**927**	**1428**
B-14	277	1234	1511	**WTP J-12**	**664**	**804**	**1468**
B-19	148	657	805	**WTP J-13**	**1581**	**1913**	**3494**
B-20	1652	7351	9003	J-08	734	889	1623
B-21	37	165	202	J-10v	150	183	333
B-22	15	65	80	**WTP J-08**	**884**	**1072**	**1956**
V-11	118	186	304	**WTP Q-03**	**219**	**404**	**623**
V-12	34	52	86				
V-14	42	67	109				
B-03	9	39	48				
B-17	2	8	10				
B-25	1569	6982	8551				
V-15	2604	4089	6693				
V-13	17	27	44				
WTP V-15	**7133**	**23632**	**30765**				

note: "Total" is sum of "the maximum daily water demand of WSS" and "the maximum daily water demand of un-supplied are

Attached Table 8.15 The Maximum Hourly Water Demand in 2028 on Each WSS

IDNo	Maximum Hourly Water Demand in 2028 (L/s)	IDNo	Maximum Hourly Water Demand in 2028 (L/s)
B-01	0.54	Q-03	5.56
B-02	1.69	Q-04	40.46
B-03	0.27	Q-05	30.28
B-04	2.02	Q-06	6.79
B-05	2.11	Q-07	7.77
B-06	0.06	R-01	11.23
B-08	2.65	R-02	5.86
B-09	2.72	R-03	8.09
B-10	3.51	R-07	13.15
B-11	2.11	R-09	12.83
B-12	4.92	R-10	5.4
B-13	2.82	R-11	16.92
B-14	7.03	R-12	5.86
B-15	0.15	R-13	3.22
B-16	0.09	R-14	10.22
B-17	0.06	R-15	11.23
B-18	2.11	R-16	2.66
B-19	3.75	R-18	7.51
B-20	36.44	R-19	14.34
B-21	1.05	R-23	3.83
B-22	0.42	R-24	5.86
B-23	1.59	R-25	7.19
B-24	23.92	R-26	12.91
B-25	34.58	R-27	5.4
J-01	5.03	R-28	20.9
J-02	2.26	R-29	19.98
J-03	2.5	R-33	4.95
J-04	2.98	R-34	7.53
J-05	8.15	R-35	8.23
J-06	2.98	R-36	15.19
J-07	8.41	R-39	3.38
J-08	16.99	V-11	2.98
J-10	3.81	V-12	0.96
J-11	7.53	V-13	0.48
J-12	15.36	V-14	1.2
J-13	34.86	V-15	54.54
Q-02	4.92		

Attached Table 8.22 Network Tables from WTP V15

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP			434.25	0
WTP	422		425.00	3.00
ET	442		445.00	3.00
V15	422	54.54	443.10	21.10
B25	425	34.58	432.84	7.84
V11	410	2.98	440.26	30.26
V12	394	0.96	419.77	25.77
V13	421	0.48	441.98	20.98
V14	390	1.2	414.44	24.44
B01	386	0.54	415.47	29.47
B03	414	0.27	444.21	30.21
B04	423	2.02	443.59	20.59
B06	384	0.06	413.82	29.82
B10	404	3.51	425.76	21.76
B11	397	2.11	420.69	23.69
B12	390	4.92	415.01	25.01
B13	402	2.82	422.35	20.35
B14	395	7.03	414.87	19.87
B17	417	0.06	438.86	21.86
B21	388	1.05	411.31	23.31
B22	382	0.42	415.52	33.52
B19	400	3.75	424.51	24.51
B20	389	36.44	410.42	21.42
Va2T	427	0	444.81	17.81
Va2-1T	414	0	444.22	30.22
Va2-2T	421	0	442.11	21.11
Va2-3T	417	0	438.86	21.86
Va3T	425	0	434.70	9.70
8-1T	401	0	430.90	29.90
11T	406	0	426.57	20.57
11-1T	397	0	425.99	28.99
11-2T	400	0	420.80	20.80
11-3T	394	0	419.90	25.90
11-4T	392	0	418.45	26.45
11-5T	390	0	417.40	27.40
11-6T	381	0	415.54	34.54
12T	387	0	411.69	24.69

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
CPWTP	CP	WTP	60	313.0
V15P	WTP	ET		Pump
B04T	ET	B04	897	96.8
V15T	ET	V15	50	176.2
V11T	ET	V11	1363	312.8
V11/8-1T	V11	8-1T	2926	312.8
UJ06-1T	8-1T	11T	1499	312.8
UJ09T	11T	11-1T	225	312.8
UJ09-1T	11-1T	11-2T	2388	312.8
UJ09-2T	11-2T	11-3T	540	312.8
UJ09-3T	11-3T	11-4T	905	312.8
UJ09-4T	11-4T	11-5T	810	312.8
UJ09-5T	11-5T	11-6T	852	277.6
UJ09-6T	11-6T	B06	825	277.6
UJ09-7T	B06	12T	1030	277.6
B10T	8-1T	B10	442	79.2
B19T	11T	B19	157	79.2
B11	11-1T	B11	1171	79.2
B13T	11-1T	B13	1249	96.8
B14T	11-2T	B14	704	110.2
V12T	11-3T	V12	49	66.0
B12T	11-4T	B12	420	96.8
B20T	12T	B20	70	176.2
B21T	12T	B21	299	79.2
V14T	11-5T	V14	1859	79.2
B01T	11-6T	B01	213	79.2
B22T	11-6T	B22	85	79.2
V15Va2T	ET	Va2T	57	246.8
IS03T	Va2T	Va2-1T	180	246.8
IS03-1T	Va2-1T	Va2-2T	646	246.8
IS03-2T	Va2-2T	Va2-3T	198	176.2
IS03-3T	Va2-3T	Va3T	254	176.2
B03	Va2-1T	B03	84	79.2
V13	Va2-2T	V13	442	79.2
B17T	Va2-3T	B17	71	79.2
B25T	Va3T	B25	68	158.6

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.23 Network Tables from WTP R12

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP		−553.1	429.78	0
WPT	370	484.1	373	3
ET	390	−48.23	393	3
R12	372	91.97	391.88	19.88

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
CPWTP	CP	WTP	220	287
WTPET	WTP	ET		Pump
R12	ET	R12	2996	555

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.24 Network Tables from WTP R24

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP		−43.8	400.58	0
WTP	366	32.8	369	3
ET	386	−5.56	389	3
17−1T	366	0	386.96	20.96
17−2T	362	0	383.78	21.78
17−3T	363	0	383.77	20.77
R24	366	5.86	386.4	20.4
J03	362	2.5	382.89	20.89
J04	363	2.98	383.54	20.54

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
CPWTP	CP	WTP	100	105
WTPET	WTP	ET		Pump
R24RR	ET	17−1T	100	110.2
UJ16−1T	17−1T	17−2T	3528	158.6
UJ16−2T	17−2T	17−3T	3	96.8
R24	17−1T	R24	49	96.8
J03	17−2T	J03	143	79.2
J04	17−3T	J04	131	110.2

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.25 Network Tables from WTP J01

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP		-298.25	380.23	0
WTP	355	259.25	358.00	3.00
ET	375	-18.22	378.00	3.00
20T	355	0	377.97	22.97
19T	355	0	376.43	21.43
21T	355	0	375.02	20.02
22T	353	0	373.53	20.53
23T	350	0	371.10	21.10
J06	355	2.98	376.18	21.18
J11v	355	7.53	376.27	21.27
J01	355	5.03	376.81	21.81
J02v	355	2.26	374.71	19.71
J07	353	8.41	372.93	19.93
J05	350	8.15	370.35	20.35

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
CPWTP	CP	WTP	100	234
J01P	WTP	ET		Pump
J01T	ET	20T	10	246.8
UJ18T	20T	19T	87	110.2
UJ19T	20T	21T	1655	220.4
UJ20T	21T	22T	355	176.2
UJ21T	22T	23T	728	141.0
J06T	19T	J06	28	79.2
J11	19T	J11v	28	123.4
J01	20T	J01	51	79.2
J02	21T	J02v	59	79.2
J07	22T	J07	171	141.0
J05T	23T	J05	68	110.2

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.26 Network Tables from WTP K01

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP		-50.01	427.48	0
WTP	375	2.01	378.00	3.00
ET	395	-32.42	398.00	3.00
Ko01T	375	0	397.95	22.95
V2-1T	373	0	397.71	24.71
R11	367	16.92	388.82	21.82
Ko1-1T	375	0	397.20	22.20
Ko3-1T	372	0	392.06	20.06
Ko3-2T	369	0	389.77	20.77
Ko3-3T	368	0	389.73	21.73
R10	372	5.4	397.18	25.18
R27	369	5.4	397.18	28.18
R33	371	4.95	391.83	20.83
R29	369	19.98	388.80	19.80
R16	369	2.66	389.68	20.68
R18	368	7.51	389.44	21.44

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
CPWTP	CP	WTP	100	234.0
WTPET	WTP	ET		Pump
Ko1T	ET	Ko01T	10	277.6
Ko01V2-1	Ko01T	V2-1T	274	246.8
R11	V2-1T	R11	690	141.0
UR02T	Ko01T	Ko1-1T	246	277.6
UR02/3/4	Ko1-1T	Ko3-1T	2798	277.6
Ko3-1Ko3-2	Ko3-1T	Ko3-2T	180	176.2
Ko3-2Ko3-3	Ko3-2T	Ko3-3T	16	158.6
R10	Ko1-1T	R10	13	141.0
R27	Ko1-1T	R27	13	141.0
R33T	Ko3-1T	R33	2618	246.8
R29T	Ko3-2T	R29	29	123.4
R16T	Ko3-3T	R16	7	79.2
R18T	Ko3-3T	R18	6	79.2

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.27 Network Tables from WTP R15

Nodes

Node ID	Elevation	Demand	Total Head	Pressure
	m	LPS	m	m
CP		-34.62	392.99	0
WTP	387	9.62	390.00	3.00
ET	407	-17.24	410.00	3.00
R15	387	11.23	409.98	22.98
Ka2-1T	377	0	407.12	30.12
Ka2T	377	0	405.78	28.78
R19	377	14.34	403.93	26.93
R34	375	7.53	398.71	23.71

Link - Node

Link ID	Start Node	End Node	Length	Diameter
			m	mm
R15	CP	WTP	409	208.0
WTPTank	WTP	ET		Pump
TankR15	ET	R15	1	176.2
R15Ka2-1	R15	Ka2-1T	409	176.2
Ka2-1Ka2	Ka2-1T	Ka2T	191	176.2
R19	Ka2T	R19	264	176.2
R34	R19	R34	947	123.4

note: CP; Connecting Point with Vakhsh Conduits,
WTP; Water Treatment Plant, ET; Elevated Tank

Attached Table 8.28 Valves List for Branches of Vakhsh Conduits

No	Valve ID	Place (between start and end)		Design Diameter	Selected Diameter	type	Pressure
		Start Node	End Node	(mm)	(mm)		(Mpa)
	For branch line						
1	V1-1	V1+	Va2+	614	700	B	0.98
2	WTPV15-1	Va2+	WTPV15	313	350	G	0.98
3	WTPR12-1	16+	R16+	287	300	G	0.98
4	WTPKo1-1	Ko1	WTPKo1	234	250	G	0.98
5	WTPR01-1	Ko3-4	TR01	208	250	G	0.98
6	V3-1	V3	Ka1	514	600	B	0.98
7	WTPR24	17-1	WTPR24	105	125	G	0.98
8	WTPJ08	30	WTPJ08	208	250	G	0.98
9	WTPJ12	31	WTPJ12	208	250	G	0.98
10	WTPJ13	31	WTPJ13	313	350	G	0.98
11	WTPJ01	20	WTPJ01	234	250	G	0.98
12	WTPR15	Ka2-1	WTPR15	208	250	G	0.98
13	WTPR07	Ka2-2	WTPR07	105	125	G	0.98
	Valve Type: Gate Valve(G), Butterfly Valve(B)						

Attached Table 8.29 Valves List for Branches of Distribution Main(1/2)

No	Valve ID	Place (between start and end)		Design Diameter	Selected Diameter	type	Pressure
		Start Node	End Node	(mm)	(mm)		(Mpa)
1	WTPV15-B04	TV15	B04	96.8	100	G	0.98
2	WTPV15-V15	TV15	V15	176.2	200	G	0.98
3	WTPV15-B03	Va2-1T	B03	79.2	80	G	0.98
4	WTPV15-V13	Va2-2T	V13	79.2	80	G	0.98
5	WTPV15-B17	Va2-3T	B17	79.2	80	G	0.98
6	WTPV15-B25	Va3T	B25	158.6	200	G	0.98
7	WTPV15-V11	V11+	V11	312.8	350	G	0.98
8	WTPV15-B10	8-1T	B10	79.2	80	G	0.98
9	WTPV15-B19	11T	B19	79.2	80	G	0.98
10	WTPV15-B13	11-1T	B13	96.8	100	G	0.98
11	WTPV15-B11	11-1T	B11	79.2	80	G	0.98
12	WTPV15-B14	11-2T	B14	110.2	125	G	0.98
13	WTPV15-B13	11-3T	V12	66	80	G	0.98
14	WTPV15-B12	11-4T	B12	96.8	100	G	0.98
15	WTPV15-V14	11-5T	V14	79.2	80	G	0.98
16	WTPV15-B22	11-6T	B22	79.2	80	G	0.98
17	WTPV15-B01	11-6T	B01	79.2	80	G	0.98
18	WTPV15-B06	11-7T	B06	79.2	80	G	0.98
19	WTPV15-B20	12T	B20	176.2	200	G	0.98
20	WTPV15-B21	12T	B21	79.2	80	G	0.98
21	WTPR12-R02	TR12	R02	124	125	G	0.98
22	WTPR12-R03	TR12	R03	200	200	G	0.98
23	WTPR12-R12	TR12	R12	105	125	G	0.98
24	WTPR12-R13	TR12	R13	105	125	G	0.98
25	WTPR12-R14	TR12	R14	105	125	G	0.98
26	WTPR12-R23	TR12	R23	96.8	100	G	0.98
27	WTPR12-R25	TR12	R25	150	150	G	0.98
28	WTPR12-R28	TR12	R28	208	250	G	0.98
29	WTPR12-R35	TR12	R35	198.2	200	G	0.98

Attached Table 8.29 Valves List for Branches of Distribution Main(2/2)

No	Valve ID	Place (between start and end)		Design Diameter	Selected Diameter	type	Pressure
		Start Node	End Node	(mm)	(mm)		(Mpa)
30	WTPR12-R36	TR12	R36	95	100	G	0.98
31	WTPR12-R39	TR12	R39	200	200	G	0.98
32	WTPKo1-R11	Ko1T	V2-1T	246.8	250	G	0.98
33	WTPKo1-R27	Ko1-1T	R27	141	150	G	0.98
34	WTPKo1-R10	Ko1-1T	R10	141	150	G	0.98
35	WTPKo1-R33	Ko3-1T	R33	246.8	250	G	0.98
36	WTPKo1-R29	Ko3-2T	R29	123.4	125	G	0.98
37	WTPKo1-R18	Ko3-3T	R18	79.2	80	G	0.98
38	WTPKo1-R16	Ko3-3T	R16	79.2	80	G	0.98
39	WTPR24-R24	17-1T	R24	96.8	100	G	0.98
40	WTPR24-J03	17-2T	J03	79.2	80	G	0.98
41	WTPR24-J04	17-3T	J04	110.2	125	G	0.98
42	WTPJ08-J08	TR08	J08	208	250	G	0.98
43	WTPJ08-J10	TR08	J08	208	250	G	0.98
44	WTPJ01-J06,J11	20T	19T	110.2	125	G	0.98
45	WTPJ01-J01	20T	J01	79.2	80	G	0.98
46	WTPJ01-J06	19T	J06	79.2	80	G	0.98
47	WTPJ01-J11	19T	J11	123.4	125	G	0.98
48	WTPJ01-J02	21T	J02	79.2	80	G	0.98
49	WTPJ01-J07	22T	J07	79.2	80	G	0.98
50	WTPJ01-J05	23T	J05	110.2	125	G	0.98
51	WTPR15-R15	TR15	R15	100	100	G	0.98
52	WTPR15-R19	TR15	R19	100	100	G	0.98
53	WTPR07-R07	TR07	R07	105	125	G	0.98
54	WTPR07-R26	TR07	R26	105	125	G	0.98

Valve Type: Gate Valve(G), Butterfly Valve(B)

Attached Table 8.30 Valves List for Separation of Vakhsh Conduits Main (1/3)

Pipe ID	Node		Length	Total Length	Diameter	Number of Valves (Each 3km)	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)		(mm)		(Mpa)
SB01	SB	HPS	1229	1229	1200				
SB02	HPS	3	5223	6,452	1192	2	1200	B	0.98
SB03	3	3-1	1776	8,228	996				
SB04	3-1	V1	1116	9,344	996	1	1000	B	0.98
IS08	Va6	Va7	1044		600				
UJ01	V1	4	1083	1083	996				
UJ02	4	5	32	1,115	900				
UJ03	5	5-1	94	1,209	900				
UJ03-1	5-1	6	238	1,447	900				
UJ04	6	7	2545	3,992	900	1	900	B	0.98
UJ05	7	8	14	4,006	900				
UJ06	8	8-1	455	4,461	900				
UJ06-1	8-1	9	1417	5,878	900				
UJ07	9	10	28	5,906	900				
UJ08	10	11	54	5,960	900				
UJ09	11	11-1	225	6,185	900	1	900	B	0.98
UJ09-1	11-1	11-2	2388	8,573	900				
UJ09-2	11-2	11-3	540	9,113	900	1	900	B	0.98
UJ09-3	11-3	11-4	905	10,018	700				
UJ09-4	11-4	11-5	810	10,828	700				
UJ09-5	11-5	11-6	852	11,680	700				
UJ09-6	11-6	B06	825	12,505	700	1	700	B	0.98
UJ09-7	B06	12	1030	13,535	700				
UJ10	12	13	156	13,691	700				
UJ11	13	14	36	13,727	700				
UJ12	14	15	22	13,749	700				
UJ13	15	16	230	13,979	700				
UJ14	16	16+	7578	21,557	700	3	700	B	0.98
UJ14-1	16-1	17	758	22,315	700				

Attached Table 8.30 Valves List for Separation of Vakhsh Conduits Main (2/3)

Pipe ID	Node		Length	Total Length	Diameter	Number of Valves (Each 3km)	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)		(mm)		(Mpa)
Uzun1	17	Uzun2	102		700				
Uzun2	Uzun2	Uz2-1	8		700				
Uzun3	Uz2-1	V2	22		700				
B25	Va3	B25	68		208				
IS01	V1+	Va1	440	440	614				
IS02	Va1	Va2	21	461	614				
IS03	Va2	Va2-1	180	641	614				
IS03-1	Va2-1	Va2-2	646	1,287	614				
IS04	Va3	Va3-1	1269	2,556	614				
IS04-1	Va3-1	Va3-2	1291	3,847	614	1	700	B	0.98
IS04-2	Va3-2	Va3-3	224	4,071	614				
IS04-3	Va3-3	Va3-4	116	4,187	614				
IS04-4	Va3-4	Va3-5	765	4,952	614	1	700	B	0.98
IS04-5	Va3-5	Va3-6	86	5,038	614				
IS04-6	Va3-6	V4	120	5,158	614	1	700	B	0.98
IS05	V4	Va4	584	5,742	614				
IS06	Va4	Va5	384	6,126	600	1	700	B	0.98
IS07	Va5	B24	40	6,166	600				
IS07-1	B24	Va6	6058	12,224	600	2	700	B	0.98
ISO3-2	Va2-2	Va2-3	198		614				
ISO3-3	Va2-3	Va3	254		614				
UJ15	V2	V3	4212	4212	514	1	700	B	0.98
UJ16	V3	17-1	978	5,190	514				
UJ16-1	17-1	17-2	3528	8,718	514	1	700	B	0.98
UJ16-2	17-2	17-3	3	8,721	514				
UJ16-3	17-3	18	1493	10,214	514	1	700	B	0.98
UJ17	18	19	4926	15,140	514	1	700	B	0.98
UJ18	19	20	87	15,227	514				
UJ19	20	21	1655	16,882	514				

Attached Table 8.30 Valves List for Separation of Vakhsh Conduits Main (3/3)

Pipe ID	Node		Length	Total Length	Diameter	Number of Valves (Each 3km)	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)		(mm)		(Mpa)
UJ20	21	22	355	17,237	514				
UJ21	22	23	728	17,965	514				
UJ23	23	24	1293	19,258	514	1	700	B	0.98
UR01	V2	V2-1	1079	1079	514				
UR01-1	V2-1	Ko1	274	1,353	514				
UR02	Ko1	Ko1-1	246	1,599	514				
UR02-1	Ko1-1	Ko2	2393	3,992	514	1	600	B	0.98
UR03	Ko2	Ko3	23	4,015	514				
UR04	Ko3	Ko3-1	382	4,397	514				
UR04-1	Ko3-1	Ko3-2	180	4,577	514				
UR04-2	Ko3-2	Ko3-3	16	4,593	514				
UR04-3	Ko3-3	Ko3-4	945	5,538	514				
UR04-4	Ko3-4	Ko4	403	5,941	514				
UR05	Ko4	V5	5	5,946	514				
UR06	V5	V5-1	882	6,828	514	1	600	B	0.98
UR07	V5-1	V5-2	167	6,995	514				
UR08	V5-2	R05	2237	9,232	514	1	600	B	0.98
Ka01	V3	Ka1	7740	7740	514	2	600	B	0.98
Ka02	Ka1	Ka2	1792	9,532	514	1	600	B	0.98
Ka03	Ka2	Ka2-1	191	9,723	514				
Ka03-1	Ka2-1	Ka2-2	6448	16,171	514	2	600	B	0.98
Ka03-2	Ka2-2	R08	2755	18,926	514				
US01	18+	30	4348	4348	414	1	500	G	0.98
US02	30	31	3492	7,840	414	1			
KaJ01	R08	KaJ3	2193	2193	313				
KaJ02	KaJ3	KaJ2	2626	4,819	313	1	400	G	0.98
KaJ03	KaJ2	KaJ1	299	5,118	313				
KaJ04	KaJ1	24	3514	8,632	313	1	400	G	0.98

Valve Type: Gate Valve(G), Butterfly Valve(B)

Attached Table 8.31 Valves List for Water Pipe Bridges of Vakhsh Conduit (1/3)

Pipe ID	Node		Length	Total Length	Diameter	Pipe Bridge Point	Number of Valve	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)			(mm)		(Mpa)
SB01	SB	HPS	1229	1229	1200	1	2	1200	B	0.98
SB02	HPS	3	5223	6,452	1192	2	4	1200	B	0.98
SB03	3	3-1	1776	8,228	996	2	4	1000	B	0.98
SB04	3-1	V1	1116	9,344	996					
IS08	Va6	Va7	1044		600					
UJ01	V1	4	1083	1083	996					
UJ02	4	5	32	1,115	900					
UJ03	5	5-1	94	1,209	900	1	2	900	B	0.98
UJ03-1	5-1	6	238	1,447	900					
UJ04	6	7	2545	3,992	900	1	2	900	B	0.98
UJ05	7	8	14	4,006	900	1	2	900	B	0.98
UJ06	8	8-1	455	4,461	900					
UJ06-1	8-1	9	1417	5,878	900					
UJ07	9	10	28	5,906	900					
UJ08	10	11	54	5,960	900					
UJ09	11	11-1	225	6,185	900					
UJ09-1	11-1	11-2	2388	8,573	900					
UJ09-2	11-2	11-3	540	9,113	900					
UJ09-3	11-3	11-4	905	10,018	700					
UJ09-4	11-4	11-5	810	10,828	700					
UJ09-5	11-5	11-6	852	11,680	700					
UJ09-6	11-6	B06	825	12,505	700					
UJ09-7	B06	12	1030	13,535	700					
UJ10	12	13	156	13,691	700					
UJ11	13	14	36	13,727	700					
UJ12	14	15	22	13,749	700					
UJ13	15	16	230	13,979	700					
UJ14	16	16+	7578	21,557	700	2	4	700	B	0.98
UJ14-1	16-1	17	758	22,315	700	1	2	700	B	0.98

Attached Table 8.31 Valves List for Water Pipe Bridges of Vakhsh Conduit (2/3)

Pipe ID	Node		Length	Total Length	Diameter	Pipe Bridge Point	Number of Valve	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)			(mm)		(Mpa)
Uzun1	17	Uzun2	102		700					
Uzun2	Uzun2	Uz2-1	8		700					
Uzun3	Uz2-1	V2	22		700					
B25	Va3	B25	68		208					
IS01	V1+	Va1	440	440	614					
IS02	Va1	Va2	21	461	614					
IS03	Va2	Va2-1	180	641	614					
IS03-1	Va2-1	Va2-2	646	1,287	614	1	2	700	B	0.98
IS04	Va3	Va3-1	1269	2,556	614					
IS04-1	Va3-1	Va3-2	1291	3,847	614	1	2	700	B	0.98
IS04-2	Va3-2	Va3-3	224	4,071	614					
IS04-3	Va3-3	Va3-4	116	4,187	614					
IS04-4	Va3-4	Va3-5	765	4,952	614	1	2	700	B	0.98
IS04-5	Va3-5	Va3-6	86	5,038	614					
IS04-6	Va3-6	V4	120	5,158	614					
IS05	V4	Va4	584	5,742	614	1	2	700	B	0.98
IS06	Va4	Va5	384	6,126	600					
IS07	Va5	B24	40	6,166	600					
IS07-1	B24	Va6	6058	12,224	600					
ISO3-2	Va2-2	Va2-3	198		614					
ISO3-3	Va2-3	Va3	254		614					
UJ15	V2	V3	4212	4212	514					
UJ16	V3	17-1	978	5,190	514					
UJ16-1	17-1	17-2	3528	8,718	514	1	2	600	B	0.98
UJ16-2	17-2	17-3	3	8,721	514					
UJ16-3	17-3	18	1493	10,214	514	2	4	600	B	0.98
UJ17	18	19	4926	15,140	514					
UJ18	19	20	87	15,227	514					
UJ19	20	21	1655	16,882	514					

Attached Table 8.31 Valves List for Water Pipe Bridges of Vakhsh Conduit (3/3)

Pipe ID	Node		Length	Total Length	Diameter	Pipe Bridge Point	Number of Valve	Selected Diameter	type	Pressure
	Start	End	(m)	(m)	(mm)			(mm)		(Mpa)
UJ20	21	22	355	17,237	514					
UJ21	22	23	728	17,965	514					
UJ23	23	24	1293	19,258	514					
UR01	V2	V2-1	1079	1079	514	1	2	600	B	0.98
UR01-1	V2-1	Ko1	274	1,353	514					
UR02	Ko1	Ko1-1	246	1,599	514					
UR02-1	Ko1-1	Ko2	2393	3,992	514	1	2	600	B	0.98
UR03	Ko2	Ko3	23	4,015	514					
UR04	Ko3	Ko3-1	382	4,397	514					
UR04-1	Ko3-1	Ko3-2	180	4,577	514	1	2	600	B	0.98
UR04-2	Ko3-2	Ko3-3	16	4,593	514					
UR04-3	Ko3-3	Ko3-4	945	5,538	514					
UR04-4	Ko3-4	Ko4	403	5,941	514					
UR05	Ko4	V5	5	5,946	514					
UR06	V5	V5-1	882	6,828	514					
UR07	V5-1	V5-2	167	6,995	514					
UR08	V5-2	R05	2237	9,232	514					
Ka01	V3	Ka1	7740	7740	514					
Ka02	Ka1	Ka2	1792	9,532	514					
Ka03	Ka2	Ka2-1	191	9,723	514					
Ka03-1	Ka2-1	Ka2-2	6448	16,171	514					
Ka03-2	Ka2-2	R08	2755	18,926	514					
US01	18+	30	4348	4348	414	1	2	500	G	0.98
US02	30	31	3492	7,840	414					
KaJ01	R08	KaJ3	2193	2193	313	1	2	400	G	0.98
KaJ02	KaJ3	KaJ2	2626	4,819	313					
KaJ03	KaJ2	KaJ1	299	5,118	313					
KaJ04	KaJ1	24	3514	8,632	313					

Valve Type: Gate Valve(G), Butterfly Valve(B)

Attached Table 8.33
Projected Distribution Pipe Length of the WSSs in the Vakhsh Rayon

(1/2)

V-11

Rayon	Vakhsh
Jamoat	Tojikobod
Water Supply System	Zarkhez village
Year of Construction	1987
Projected Year of Completion	2012
Population in 2007	700
Projected Population in 2012	773
Maximum Hourly Water Demand in 2028 (liter/second)	2.98
Number of Communal Taps in 2007	60
Population per Tap in 2007	12
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	90	5.4	79.2	1300
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

V-12

Rayon	Vakhsh
Jamoat	Tojikobod
Water Supply System	Military part MChS
Year of Construction	2000
Projected Year of Completion	2012
Population in 2007	200
Projected Population in 2012	221
Maximum Hourly Water Demand in 2028 (liter/second)	0.96
Number of Communal Taps in 2007	4
Population per Tap in 2007	50
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	90	5.4	79.2	100
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

V-13

Rayon	Vakhsh
Jamoat	Tojikobod
Water Supply System	Pakhtaobod village
Year of Construction	1987
Projected Year of Completion	2012
Population in 2007	100
Projected Population in 2012	110
Maximum Hourly Water Demand in 2028 (liter/second)	0.48
Number of Communal Taps in 2007	4
Population per Tap in 2007	25
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	90	5.4	79.2	900
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.33
Projected Distribution Pipe Length of the WSSs in the Vakhsh Rayon

(2/2)

V-14

Rayon	Vakhsh
Jamoat	Tojikobod
Water Supply System	Navobod village
Year of Construction	1980
Projected Year of Completion	2012
Population in 2007	250
Projected Population in 2012	276
Maximum Hourly Water Demand in 2028 (liter/second)	1.2
Number of Communal Taps in 2007	22
Population per Tap in 2007	11
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	110	6.6	96.8	3600
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

V-15

Rayon	Vakhsh
Jamoat	Tojikobod
Water Supply System	c/f S.Jumaev
Year of Construction	1980
Projected Year of Completion	2012
Population in 2007	17667
Projected Population in 2012	19512
Maximum Hourly Water Demand in 2028 (liter/second)	54.54
Number of Communal Taps in 2007	340
Population per Tap in 2007	52
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	255	13.4	228.2	1800
Distribution main 2	existing	PVC	280	10.7	258.6	1620
Distribution sub-main 1	new	HDPE	125	7.4	110.2	6600
Distribution sub-main 2	existing	PVC	160	6.2	147.6	6000
Distribution sub-main 3	new	HDPE	90	5.4	79.2	11000
Distribution sub-main 4	existing	PVC	110	4.2	101.6	10000

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(1/9)

R-01

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Jomi jamoat Tugalang
Year of Construction	1987
Projected Year of Completion	2018
Population in 2007	2497
Projected Population in 2018	3191
Maximum Hourly Water Demand in 2028 (liter/second)	11.23
Number of Communal Taps in 2007	25
Population per Tap in 2007	100
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	450	26.7	396.6	1500
Distribution main 2						
Distribution sub-main 1	new	HDPE	200	11.9	176.2	3800
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-02

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Ittifoq-1
Year of Construction	1974
Projected Year of Completion	2017
Population in 2007	1300
Projected Population in 2017	1628
Maximum Hourly Water Demand in 2028 (liter/second)	5.86
Number of Communal Taps in 2007	20
Population per Tap in 2007	65
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	3500
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-03

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Pakhtaaral Street
Year of Construction	1978
Projected Year of Completion	2017
Population in 2007	1800
Projected Population in 2017	2254
Maximum Hourly Water Demand in 2028 (liter/second)	8.09
Number of Communal Taps in 2007	12
Population per Tap in 2007	150
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	450	26.7	396.6	600
Distribution main 2						
Distribution sub-main 1	new	HDPE	250	14.8	220.4	1900
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(2/9)

R-06

Rayon	Kolkhozabad
Jamoat	S. Isaeva
Water Supply System	Central district hospital
Year of Construction	1978
Projected Year of Completion	2020
Population in 2007	1800
Projected Population in 2020	2394
Maximum Hourly Water Demand in 2028 (liter/second)	8.09
Number of Communal Taps in 2007	12
Population per Tap in 2007	150
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	355	21.1	312.8	900
Distribution main 2						
Distribution sub-main 1	new	HDPE	180	10.7	158.6	1300
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-07

Rayon	Kolkhozabad
Jamoat	Kalinin
Water Supply System	40 year Oktyabr
Year of Construction	1974
Projected Year of Completion	2018
Population in 2007	3200
Projected Population in 2018	4089
Maximum Hourly Water Demand in 2028 (liter/second)	13.15
Number of Communal Taps in 2007	20
Population per Tap in 2007	160
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	250	14.8	220.4	3200
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-09

Rayon	Kolkhozabad
Jamoat	Kalinin
Water Supply System	Uzbekobod Street
Year of Construction	1984
Projected Year of Completion	2013
Population in 2007	2854
Projected Population in 2013	3279
Maximum Hourly Water Demand in 2028 (liter/second)	12.83
Number of Communal Taps in 2007	35
Population per Tap in 2007	82
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	160	9.5	141	1800
Distribution main 2	existing	HDPE	110	6.6	96.8	1600
Distribution sub-main 1	new	HDPE	140	8.3	123.4	2300
Distribution sub-main 2	existing	HDPE	90	5.4	79.2	2000
Distribution sub-main 3	new	HDPE	110	6.6	96.8	2300
Distribution sub-main 4	existing	HDPE	75	4.5	66	1000

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(3/9)

R-10

Rayon	Kolkhozabad
Jamoat	Madaniyat
Water Supply System	Qizil-bairak kolkhoz T. Esanqulov
Year of Construction	1985
Projected Year of Completion	2018
Population in 2007	1202
Projected Population in 2018	1536
Maximum Hourly Water Demand in 2028 (liter/second)	5.4
Number of Communal Taps in 2007	30
Population per Tap in 2007	40
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	160	9.5	141	1500
Distribution main 2	existing	HDPE	160	9.5	141	1200
Distribution sub-main 1	new	HDPE	110	6.6	96.8	3800
Distribution sub-main 2	new	HDPE	110	6.6	96.8	3000
Distribution sub-main 3						
Distribution sub-main 4						

R-11

Rayon	Kolkhozabad
Jamoat	Madaniyat
Water Supply System	kolkhoz T. Esanqulov
Year of Construction	1978
Projected Year of Completion	2018
Population in 2007	4120
Projected Population in 2018	5264
Maximum Hourly Water Demand in 2028 (liter/second)	16.92
Number of Communal Taps in 2007	30
Population per Tap in 2007	137
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	355	21.1	312.8	5100
Distribution main 2						
Distribution sub-main 1	new	HDPE	225	13.4	198.2	1000
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-12

Rayon	Kolkhozabad
Jamoat	Navobod
Water Supply System	Urtabuz
Year of Construction	1987
Projected Year of Completion	2017
Population in 2007	1300
Projected Population in 2017	1628
Maximum Hourly Water Demand in 2028 (liter/second)	5.86
Number of Communal Taps in 2007	15
Population per Tap in 2007	87
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	200	11.9	176.2	1800
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(4/9)

R-13

Rayon	Kolkhozabad
Jamoat	Navobod
Water Supply System	Qizil Namuna c/farm N. Begova
Year of Construction	1962
Projected Year of Completion	2017
Population in 2007	714
Projected Population in 2017	894
Maximum Hourly Water Demand in 2028 (liter/second)	3.22
Number of Communal Taps in 2007	
Population per Tap in 2007	
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	160	9.5	141	5100
Distribution main 2						
Distribution sub-main 1	new	HDPE	90	5.4	79.2	2600
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-14

Rayon	Kolkhozabad
Jamoat	Navobod
Water Supply System	Andreev collective farm N.Begova
Year of Construction	1964
Projected Year of Completion	2017
Population in 2007	2274
Projected Population in 2017	2847
Maximum Hourly Water Demand in 2028 (liter/second)	10.22
Number of Communal Taps in 2007	30
Population per Tap in 2007	76
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	200	11.9	176.2	6500
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-15

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Engels of Tugalang Jamoat
Year of Construction	1987
Projected Year of Completion	2012
Population in 2007	2500
Projected Population in 2012	2668
Maximum Hourly Water Demand in 2028 (liter/second)	11.23
Number of Communal Taps in 2007	25
Population per Tap in 2007	100
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	315	18.7	277.6	2100
Distribution main 2						
Distribution sub-main 1	new	HDPE	200	11.9	176.2	900
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(5/9)

R-16

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Khlopkorob Street
Year of Construction	1978
Projected Year of Completion	2018
Population in 2007	590
Projected Population in 2018	754
Maximum Hourly Water Demand in 2028 (liter/second)	2.66
Number of Communal Taps in 2007	18
Population per Tap in 2007	33
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	140	8.3	123.4	1800
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-18

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Lenin jamoat Tugalang
Year of Construction	1978
Projected Year of Completion	2018
Population in 2007	1670
#REF!	2134
Maximum Hourly Water Demand in 2028 (liter/second)	7.51
Number of Communal Taps in 2007	25
Population per Tap in 2007	67
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	180	10.7	158.6	2300
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-19

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Leningrad jamoat Tugalang
Year of Construction	1987
Projected Year of Completion	2012
Population in 2007	3493
Projected Population in 2012	3926
Maximum Hourly Water Demand in 2028 (liter/second)	14.34
Number of Communal Taps in 2007	28
Population per Tap in 2007	125
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	200	11.9	176.2	1100
Distribution main 2						
Distribution sub-main 1	new	HDPE	110	6.6	96.8	3400
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(6/9)

R-23

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Ittifoq Jumaev collective farm
Year of Construction	2001
Projected Year of Completion	2017
Population in 2007	850
Projected Population in 2017	1064
Maximum Hourly Water Demand in 2028 (liter/second)	3.83
Number of Communal Taps in 2007	32
Population per Tap in 2007	27
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	125	7.4	110.2	1100
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-24

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	K. Marks
Year of Construction	1987
Projected Year of Completion	2014
Population in 2007	1300
Projected Population in 2014	1527
Maximum Hourly Water Demand in 2028 (liter/second)	5.86
Number of Communal Taps in 2007	5
Population per Tap in 2007	260
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	315	18.7	277.6	700
Distribution main 2						
Distribution sub-main 1	new	HDPE	200	11.9	176.2	1200
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-25

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Pravda S. Jumaev collective farm
Year of Construction	1978
Projected Year of Completion	2017
Population in 2007	1593
Projected Population in 2017	1994
Maximum Hourly Water Demand in 2028 (liter/second)	7.19
Number of Communal Taps in 2007	30
Population per Tap in 2007	53
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	250	14.8	220.4	2500
Distribution main 2						
Distribution sub-main 1	new	HDPE	160	9.5	141	3100
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

R-26

Rayon	Kolkhozabad
Jamoat	Kalinin
Water Supply System	construction village Kalenina
Year of Construction	1986
Projected Year of Completion	2018
Population in 2007	3142
Projected Population in 2018	4015
Maximum Hourly Water Demand in 2028 (liter/second)	12.91
Number of Communal Taps in 2007	45
Population per Tap in 2007	70
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	180	10.7	158.6	3800
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-27

Rayon	Kolkhozabad
Jamoat	Madaniyat
Water Supply System	Esanqulov collective farm
Year of Construction	1985
Projected Year of Completion	2018
Population in 2007	1200
Projected Population in 2018	1533
Maximum Hourly Water Demand in 2028 (liter/second)	5.4
Number of Communal Taps in 2007	12
Population per Tap in 2007	100
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	140	8.3	123.4	1800
Distribution main 2						
Distribution sub-main 1	new	HDPE	110	6.6	96.8	4500
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-28

Rayon	Kolkhozabad
Jamoat	Navobod
Water Supply System	Chapeav
Year of Construction	1980
Projected Year of Completion	2017
Population in 2007	5510
Projected Population in 2017	6898
Maximum Hourly Water Demand in 2028 (liter/second)	20.9
Number of Communal Taps in 2007	85
Population per Tap in 2007	65
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	355	8.3	338.4	1000
Distribution main 2						
Distribution sub-main 1	new	HDPE	250	14.8	220.4	1300
Distribution sub-main 2	new	HDPE	180	10.7	158.6	5000
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(8/9)

R-29

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Communist jamoat Tugalang
Year of Construction	1987
Projected Year of Completion	2018
Population in 2007	4862
Projected Population in 2018	6212
Maximum Hourly Water Demand in 2028 (liter/second)	19.98
Number of Communal Taps in 2007	25
Population per Tap in 2007	194
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	400	23.7	352.6	2600
Distribution main 2						
Distribution sub-main 1	new	HDPE	280	16.6	246.8	3800
Distribution sub-main 2	new	HDPE	140	8.3	123.4	600
Distribution sub-main 3						
Distribution sub-main 4						

R-30

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Galaba jamoat Tugalang
Year of Construction	1987
Projected Year of Completion	2020
Population in 2007	1101
Projected Population in 2020	1464
Maximum Hourly Water Demand in 2028 (liter/second)	4.95
Number of Communal Taps in 2007	26
Population per Tap in 2007	42
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	160	9.5	141	1900
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-34

Rayon	Kolkhozabad
Jamoat	Tugalang
Water Supply System	Shakhtiyor Street of Tugalang
Year of Construction	1987
Projected Year of Completion	2012
Population in 2007	1673
Projected Population in 2012	1880
Maximum Hourly Water Demand in 2028 (liter/second)	7.53
Number of Communal Taps in 2007	38
Population per Tap in 2007	44
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	160	9.5	141	1800
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.34
Projected Distribution Pipe Length of the WSSs in the Kolkhozobod Rayon

(9/9)

R-35

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Sanoat
Year of Construction	1988
Projected Year of Completion	2017
Population in 2007	1832
Projected Population in 2017	2294
Maximum Hourly Water Demand in 2028 (liter/second)	8.23
Number of Communal Taps in 2007	75
Population per Tap in 2007	24
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	250	14.8	220.4	800
Distribution main 2						
Distribution sub-main 1	new	HDPE	180	10.7	158.6	2000
Distribution sub-main 2	new	HDPE	125	7.4	110.2	1800
Distribution sub-main 3						
Distribution sub-main 4						

R-36

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Pakhtaobod Jamoat Uzun
Year of Construction	1986
Projected Year of Completion	2017
Population in 2007	3700
Projected Population in 2017	4632
Maximum Hourly Water Demand in 2028 (liter/second)	15.19
Number of Communal Taps in 2007	120
Population per Tap in 2007	31
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	2300
Distribution main 2						
Distribution sub-main 1	new	HDPE	110	6.6	96.8	4600
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

R-39

Rayon	Kolkhozabad
Jamoat	Uzun
Water Supply System	Mehnatobod Jamoat Uzun from S. Jumaev collective farm
Year of Construction	1988
Projected Year of Completion	2017
Population in 2007	748
Projected Population in 2017	936
Maximum Hourly Water Demand in 2028 (liter/second)	3.38
Number of Communal Taps in 2007	62
Population per Tap in 2007	12
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	2300
Distribution main 2						
Distribution sub-main 1	new	HDPE	160	9.5	141	4600
Distribution sub-main 2	new	HDPE	125	7.4	110.2	2500
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.35
Projected Distribution Pipe Length of the WSSs in the Dzhilikul Rayon

(1/3)

J-01

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Agronomy village of Dehkanabad Jamoat
Year of Construction	1990
Projected Year of Completion	2014
Population in 2007	1138
Projected Population in 2014	1335
Maximum Hourly Water Demand in 2028 (liter/second)	5.03
Number of Communal Taps in 2007	16
Population per Tap in 2007	71
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	1600
Distribution main 2	existing	PVC	160	6.2	147.6	1400
Distribution sub-main 1	new	HDPE	160	9.5	141	2300
Distribution sub-main 2	existing	PVC	110	4.2	101.6	2000
Distribution sub-main 3						
Distribution sub-main 4						

J-03

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Kirov village of Dehkanabad Jamoat
Year of Construction	1990
Projected Year of Completion	2014
Population in 2007	566
Projected Population in 2014	649
Maximum Hourly Water Demand in 2028 (liter/second)	2.5
Number of Communal Taps in 2007	15
Population per Tap in 2007	38
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	1100
Distribution main 2						
Distribution sub-main 1	new	HDPE	140	8.3	123.4	700
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

J-04

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Moskva village of Dehkanabad Jamoat
Year of Construction	1991
Projected Year of Completion	2014
Population in 2007	672
Projected Population in 2014	788
Maximum Hourly Water Demand in 2028 (liter/second)	2.98
Number of Communal Taps in 2007	15
Population per Tap in 2007	45
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	225	13.4	198.2	1100
Distribution main 2						
Distribution sub-main 1	new	HDPE	160	9.5	141.0	1200
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.35
Projected Distribution Pipe Length of the WSSs in the Dzhilikul Rayon

(2/3)

J-05

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Kuibeshev village, Dehkanabad Jamoat
Year of Construction	1990
Projected Year of Completion	2014
Population in 2007	1837
Projected Population in 2014	2154
Maximum Hourly Water Demand in 2028 (liter/second)	8.15
Number of Communal Taps in 2007	30
Population per Tap in 2007	61
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	250	14.8	220.4	700
Distribution main 2						
Distribution sub-main 1	new	HDPE	180	10.7	158.6	5900
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

J-06

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Surh Ribhoz village
Year of Construction	1976
Projected Year of Completion	2014
Population in 2007	670
Projected Population in 2014	786
Maximum Hourly Water Demand in 2028 (liter/second)	2.98
Number of Communal Taps in 2007	10
Population per Tap in 2007	67
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	180	10.7	158.6	1600
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

J-07

Rayon	Dzhilikul
Jamoat	Dehkanabad
Water Supply System	Mirovoy village
Year of Construction	1988
Projected Year of Completion	2014
Population in 2007	1897
Projected Population in 2014	2225
Maximum Hourly Water Demand in 2028 (liter/second)	8.41
Number of Communal Taps in 2007	25
Population per Tap in 2007	76
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	400	23.7	352.6	400
Distribution main 2						
Distribution sub-main 1	new	HDPE	280	16.6	246.8	2900
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.35
Projected Distribution Pipe Length of the WSSs in the Dzhilikul Rayon

(3/3)

J-08

Rayon	Dzhilikul
Jamoat	Kabadiyon
Water Supply System	area Kabadiyon
Year of Construction	1989
Projected Year of Completion	2014
Population in 2007	4200
Projected Population in 2014	4926
Maximum Hourly Water Demand in 2028 (liter/second)	16.99
Number of Communal Taps in 2007	26
Population per Tap in 2007	162
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	500	29.7	440.6	1400
Distribution main 2						
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

J-12

Rayon	Dzhilikul
Jamoat	Nuri Vakhsh
Water Supply System	Ergash Sattarov Kolhoz
Year of Construction	1987
Projected Year of Completion	2014
Population in 2007	3800
Projected Population in 2014	4457
Maximum Hourly Water Demand in 2028 (liter/second)	15.36
Number of Communal Taps in 2007	40
Population per Tap in 2007	95
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	180	10.7	158.6	8000
Distribution main 2	existing	PVC	160	6.2	147.6	6800
Distribution sub-main 1	new	HDPE	125	7.4	110.2	11700
Distribution sub-main 2	new	HDPE	125	7.4	110.2	10000
Distribution sub-main 3						
Distribution sub-main 4						

J-13

Rayon	Dzhilikul
Jamoat	Nuri Vakhsh
Water Supply System	s/z Moskva k/z E. Satorov
Year of Construction	1987
Projected Year of Completion	2014
Population in 2007	9800
Projected Population in 2014	11494
Maximum Hourly Water Demand in 2028 (liter/second)	34.86
Number of Communal Taps in 2007	75
Population per Tap in 2007	131
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	280	16.6	246.8	3300
Distribution main 2						
Distribution sub-main 1	new	HDPE	180	10.7	158.6	6600
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.36
Projected Distribution Pipe Length of the WSSs in the Kumsangir Rayon

(1/2)

Q-02

Rayon	Kumsangir
Jamoat	Krupskaya
Water Supply System	Drinkable
Year of Construction	1985
Projected Year of Completion	2013
Population in 2007	1112
Projected Population in 2013	1275
Maximum Hourly Water Demand in 2028 (liter/second)	4.92
Number of Communal Taps in 2007	26
Population per Tap in 2007	43
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	PVC	110	4.2	101.6	400
Distribution main 2	existing	PVC	110	4.2	101.6	2600
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Q-03

Rayon	Kumsangir
Jamoat	Krupskaya
Water Supply System	Drinkable
Year of Construction	1986
Projected Year of Completion	2013
Population in 2007	1255
Projected Population in 2013	1439
Maximum Hourly Water Demand in 2028 (liter/second)	5.56
Number of Communal Taps in 2007	30
Population per Tap in 2007	42
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	110	6.6	96.8	3000
Distribution main 2	existing	HDPE	110	6.6	96.8	2600
Distribution sub-main 1	new	HDPE	90	5.4	79.2	3000
Distribution sub-main 2	new	HDPE	90	5.4	79.2	2600
Distribution sub-main 3						
Distribution sub-main 4						

Q-04

Rayon	Kumsangir
Jamoat	Pyanj
Water Supply System	Lenin kolkhoz of Qumsangir village
Year of Construction	1987
Projected Year of Completion	2013
Population in 2007	11979
Projected Population in 2013	13733
Maximum Hourly Water Demand in 2028 (liter/second)	40.46
Number of Communal Taps in 2007	88
Population per Tap in 2007	136
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	280	16.6	246.8	19500
Distribution main 2	existing	PVC	225	8.6	207.8	17000
Distribution sub-main 1	new	HDPE	200	11.9	176.2	20600
Distribution sub-main 2	existing	PVC	160	6.3	147.4	18000
Distribution sub-main 3						
Distribution sub-main 4						

Attached Table 8.36
Projected Distribution Pipe Length of the WSSs in the Kumsangir Rayon

(2/2)

Q-05

Rayon	Kumsangir
Jamoat	Telman
Water Supply System	drinkable
Year of Construction	1988
Projected Year of Completion	2013
Population in 2007	8496
Projected Population in 2013	9740
Maximum Hourly Water Demand in 2028 (liter/second)	30.28
Number of Communal Taps in 2007	35
Population per Tap in 2007	243
Remarks	pump pressurized distribution

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	250	14.8	220.4	1100
Distribution main 2						
Distribution sub-main 1	new	HDPE	200	11.9	176.2	2300
Distribution sub-main 2	new	HDPE	125	7.4	110.2	4600
Distribution sub-main 3						
Distribution sub-main 4						

Q-06

Rayon	Kumsangir
Jamoat	Krupskaya
Water Supply System	village Udarnik
Year of Construction	1987
Projected Year of Completion	2013
Population in 2007	1534
Projected Population in 2013	1759
Maximum Hourly Water Demand in 2028 (liter/second)	6.79
Number of Communal Taps in 2007	40
Population per Tap in 2007	38
Remarks	

Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	140	8.3	123.4	3400
Distribution main 2						
Distribution sub-main 1	new	HDPE	110	6.6	96.8	3200
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

Q-07

Rayon	Kumsangir
Jamoat	Krupskaya
Water Supply System	Drinkable
Year of Construction	1985
Projected Year of Completion	2013
Population in 2007	1749
Projected Population in 2013	2005
Maximum Hourly Water Demand in 2028 (liter/second)	7.77
Number of Communal Taps in 2007	24
Population per Tap in 2007	73
Remarks	pump pressurized distribution

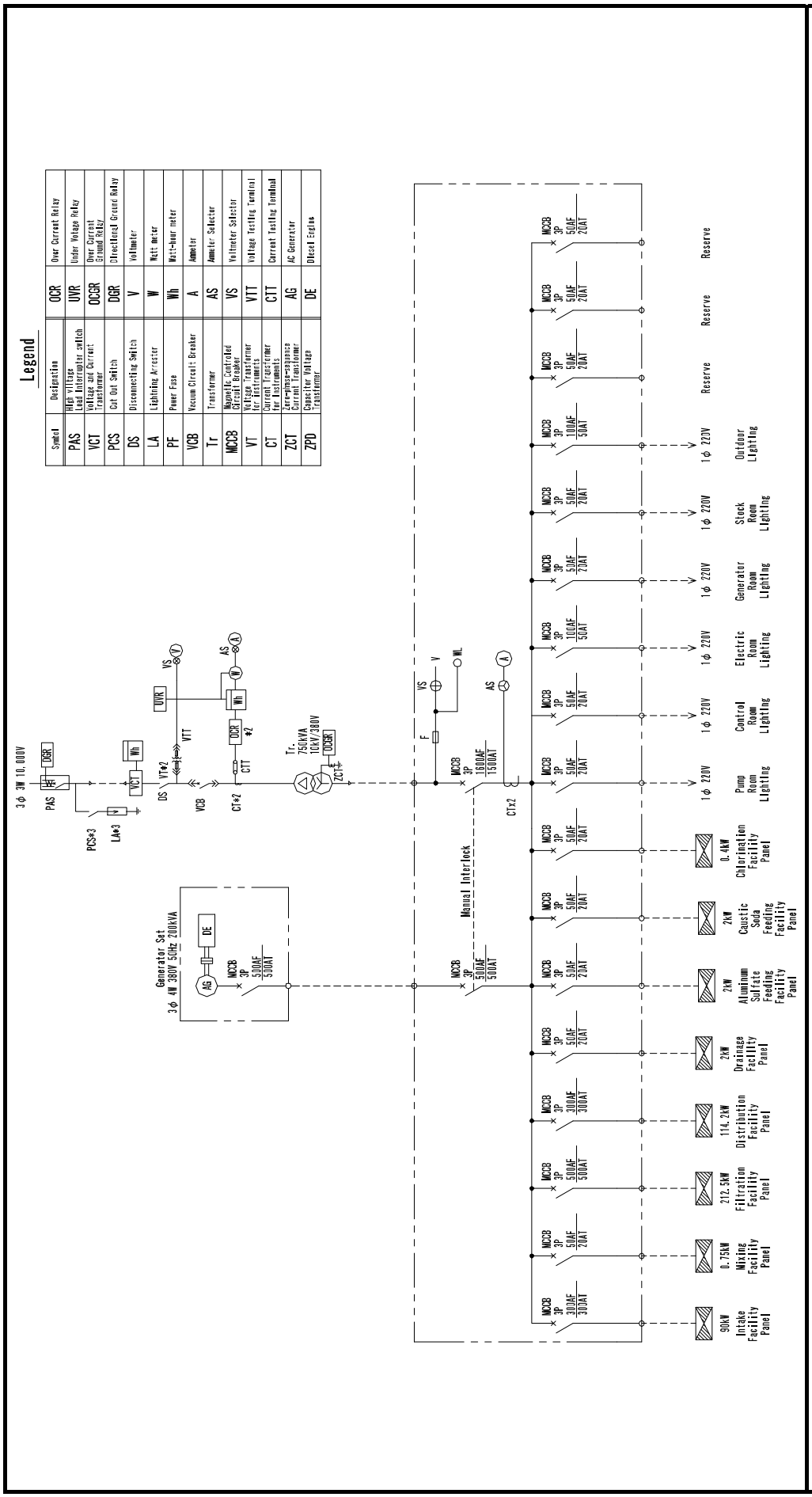
Proposed Distribution Pipes

	Status	Pipe material	Outside dia. (mm)	Pipe wall thickness (mm)	Inside dia (mm)	Length (m)
Distribution main 1	new	HDPE	140	8.3	123.4	2800
Distribution main 2	existing	HDPE	110	6.6	96.8	2400
Distribution sub-main 1						
Distribution sub-main 2						
Distribution sub-main 3						
Distribution sub-main 4						

3 CHAPTER 8 REHABILITATION AND EXPANSION PLAN OF THE VAKHSH CONDUITS

Appendix Detail of Rehabilitation and extension Plan for the Vakhsh Conduits

（2）Attached Figures



Attached Figure 8.1.6 Single Diagram of Water Treatment Plant of TV15

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN

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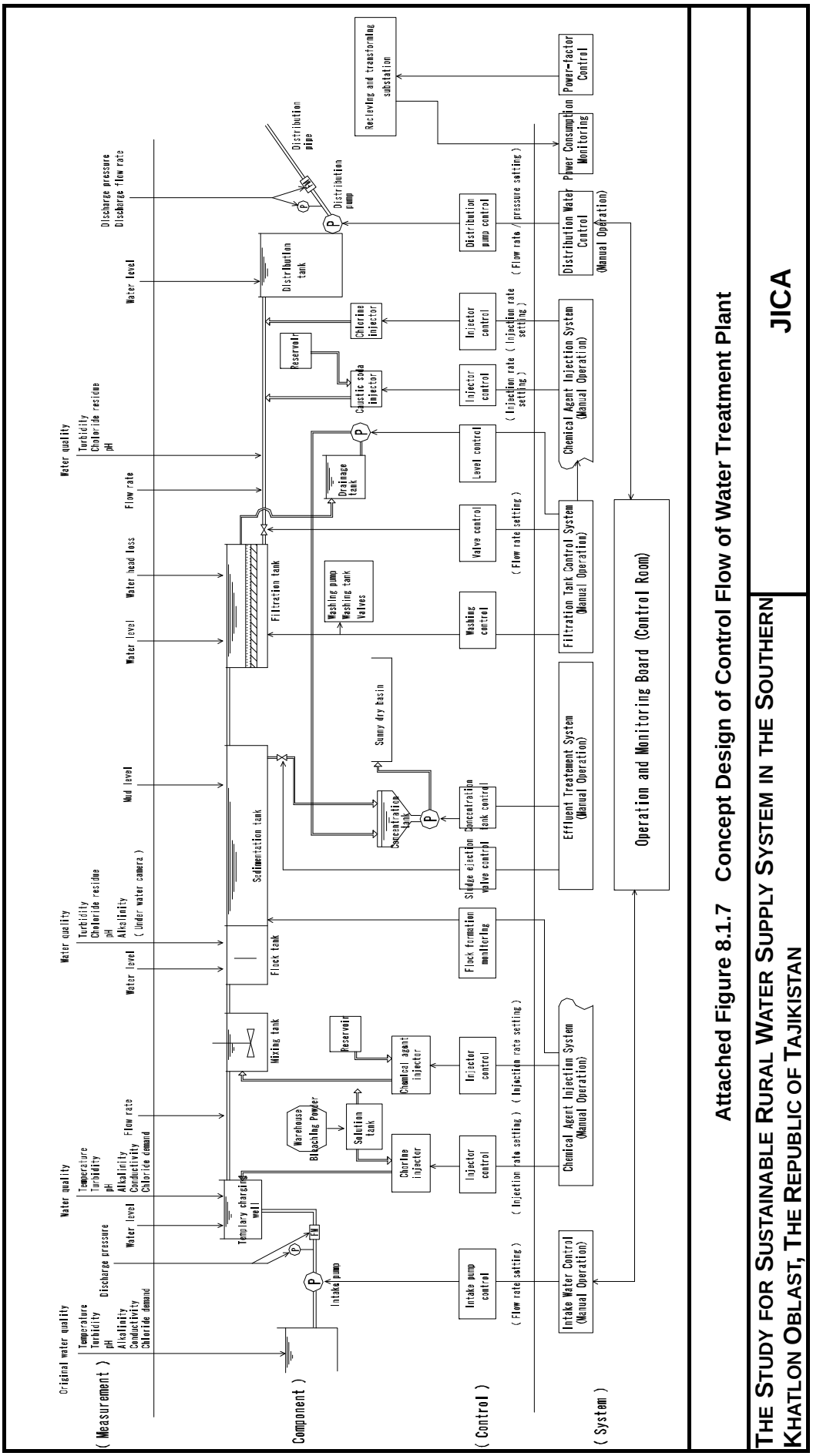

Attached Figure 8.1.7 Concept Design of Control Flow of Water Treatment Plant

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN

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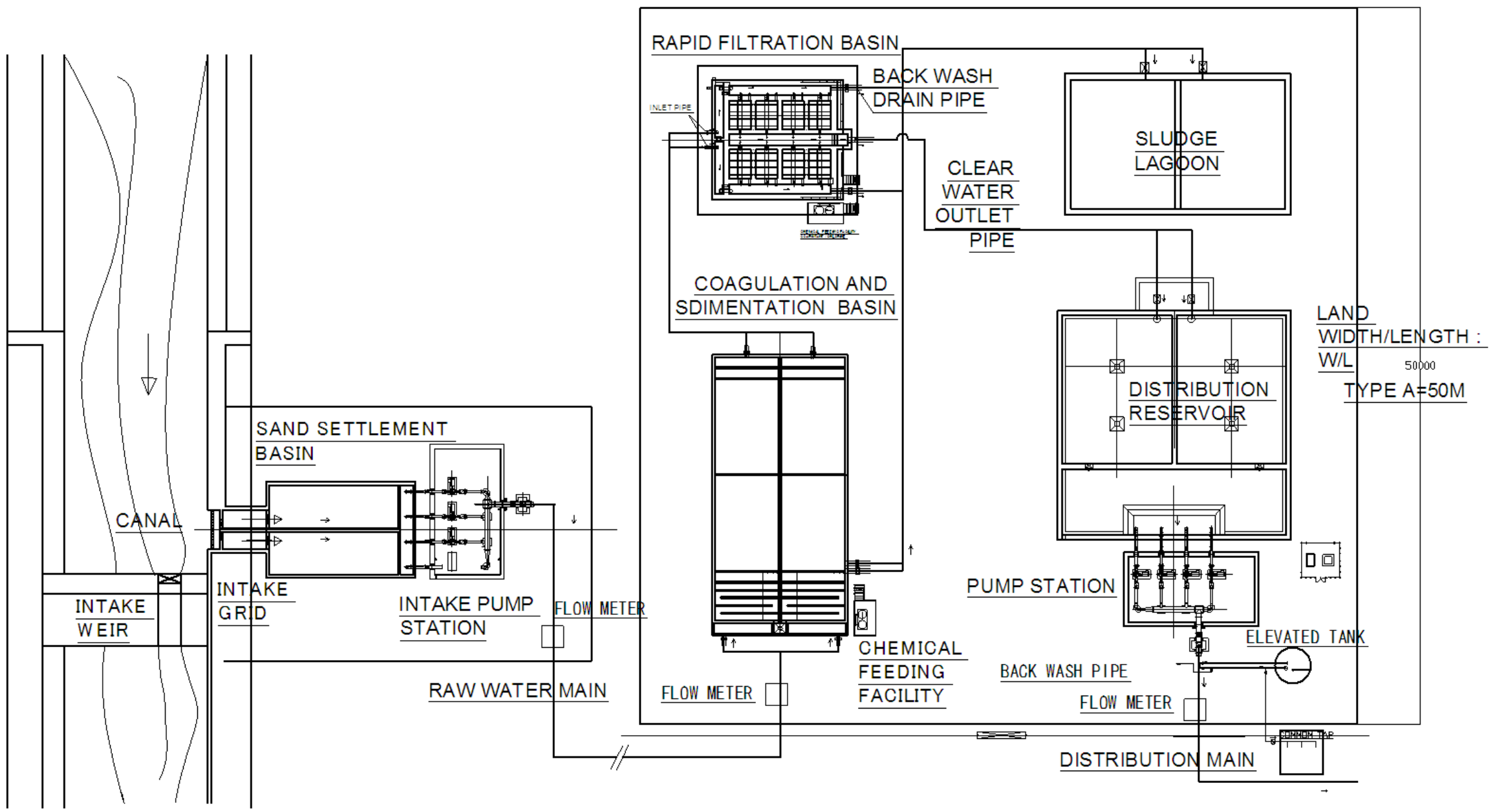
SITE PLAN TYPE A and B

WATER TREATMENT PLANT TYPE A and B

FILTRATION CAPACITY:
TYPE A : MAX. 2,800m3/day,
TYPE B: MAX. 8,200m3/day,
FILTRATION SPEED: MAX. 150m/day



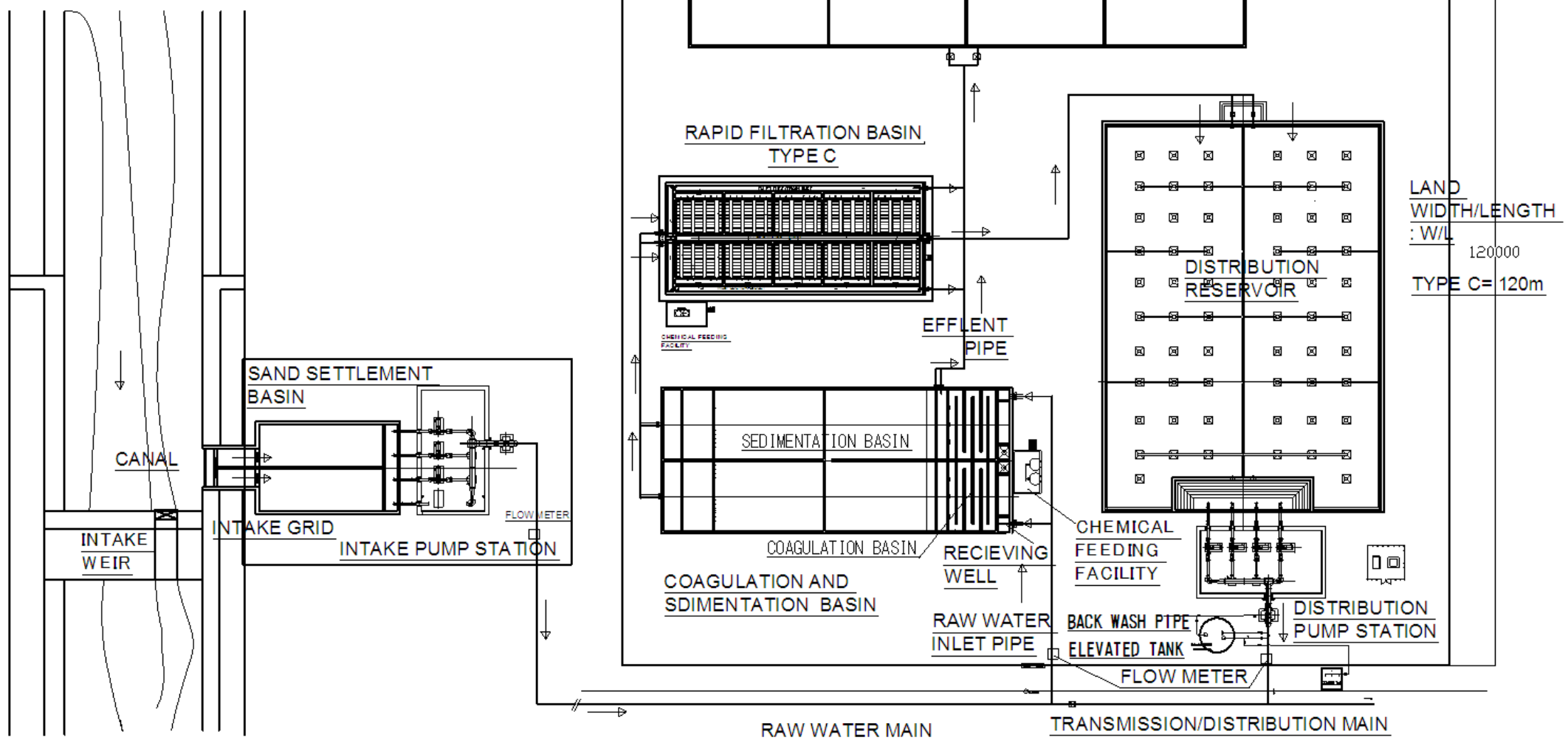
ATTACHED FIGURE 8.1.8 SITE PLAN (FACILITY ARANGEMENT PLAN) TYPE A/B

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN | JICA

SITE PLAN TYPE C

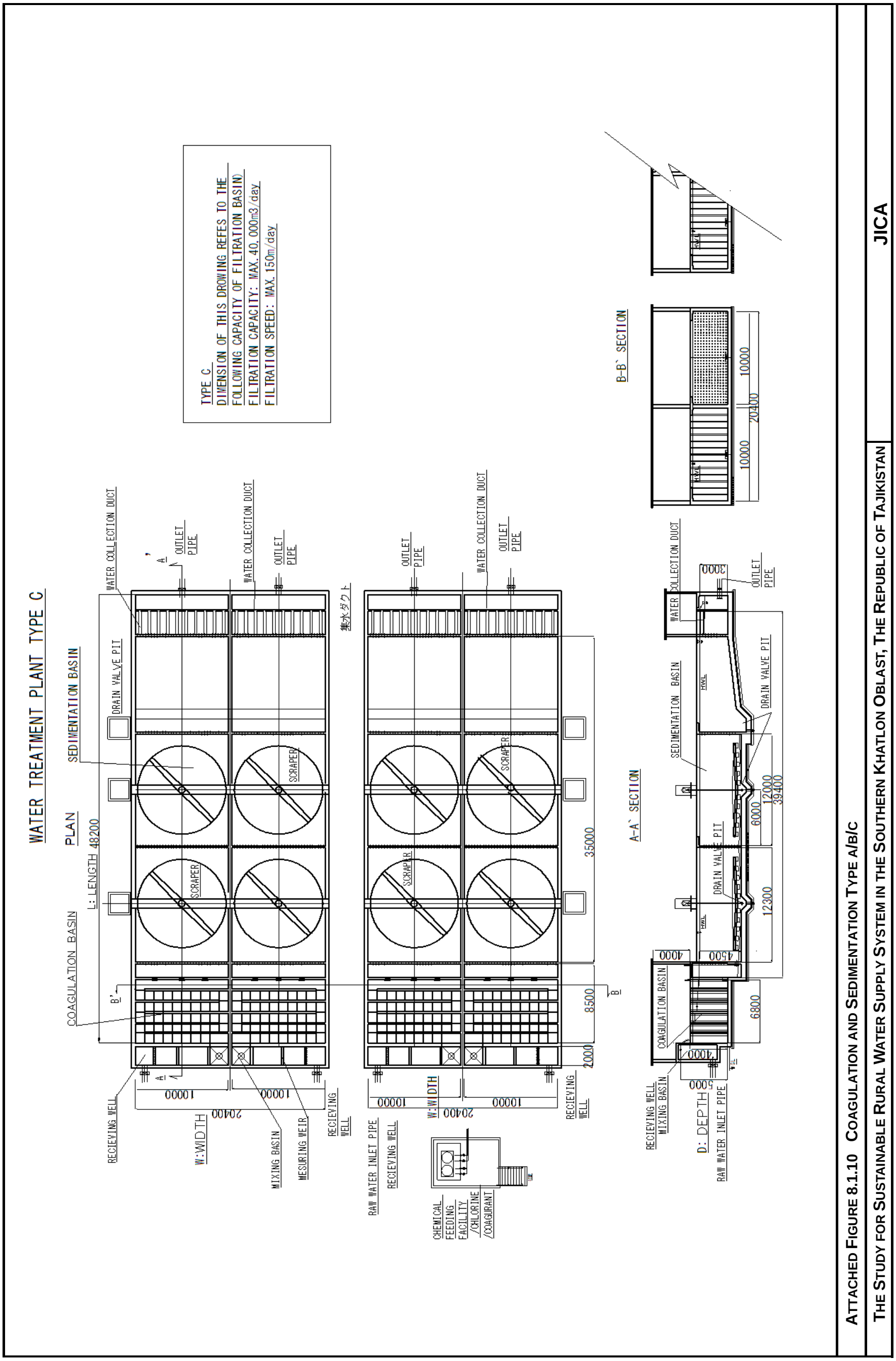
WATER TREATMENT PLANT TYPE C : 40,000m3/day

FILTRATION CAPACITY:
TYPE C : MAX. 40,00m3/day
FILTRATION SPEED: MAX. 150m/day



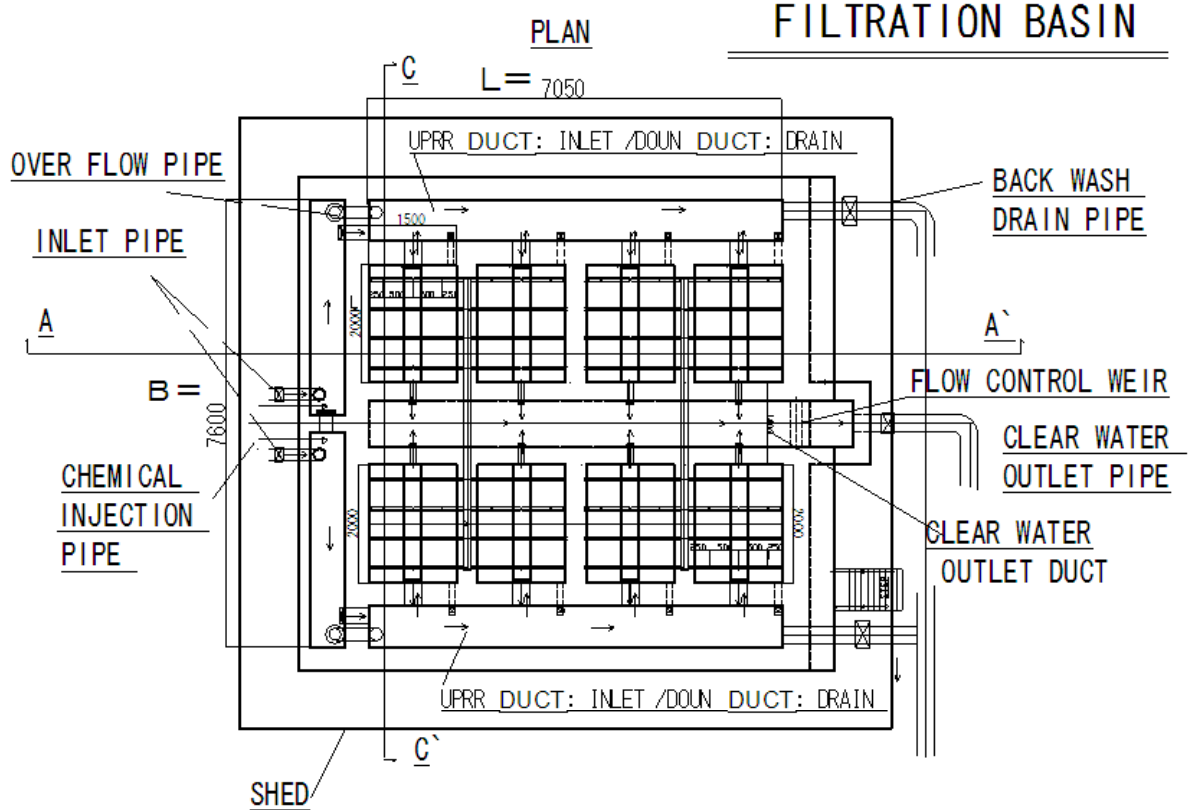
ATTACHED FIGURE 8.1.9 SITE PLAN (FACILITY ARRANGEMENT PLAN)TYPE C/D

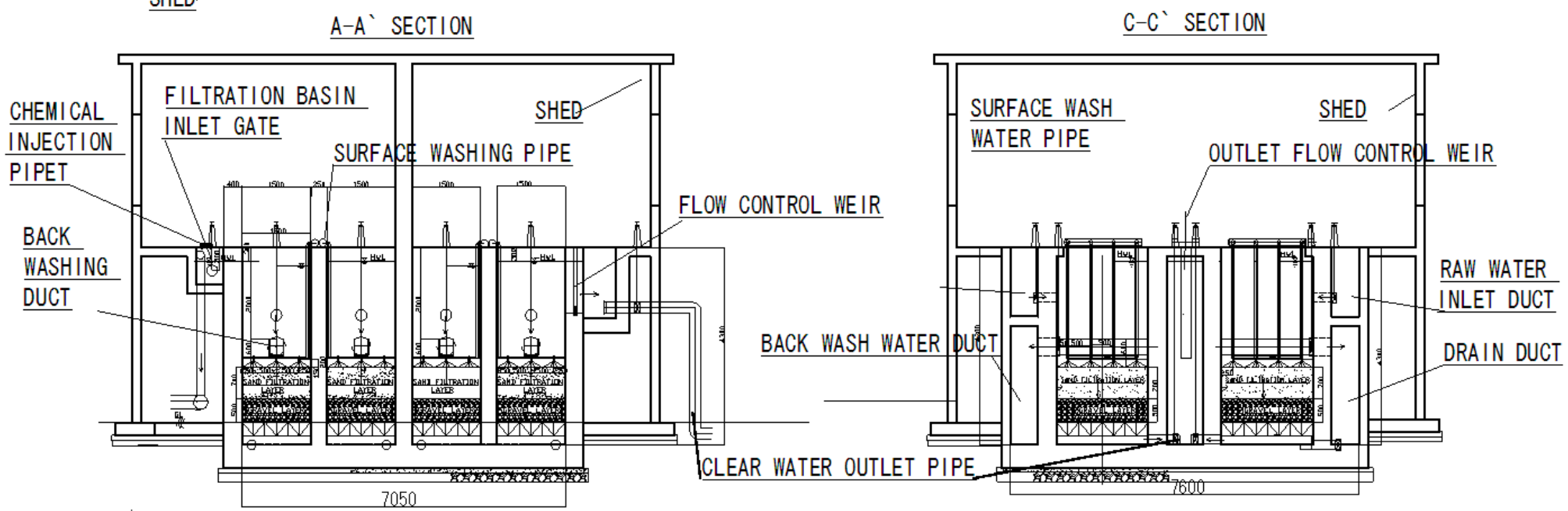
THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN | JICA


TYPE C
DIMENSION OF THIS DROWING REFES TO THE FOLLOWING CAPACITY OF FILTRATION BASIN)
FILTRATION CAPACITY: MAX. 40, 000m3/day
FILTRATION SPEED: MAX. 150m/day
WATER TREATMENT PLANT TYPE C
PLAN
L: LENGTH 48200
COAGULATION BASIN
SEDIMENTATION BASIN
WATER COLLECTION DUCT
OUTLET PIPE
DRAIN VALVE PIT
SCRAPER
集水ダクト
35000
8500
2000
20400
10000
RECIEVING WELL
W:WIDTH
MIXING BASIN
MESURING WEIR
RAW WATER INLET PIPE
CHEMICAL FEEDING FACILITY /CHLORINE /COAGURANT
B-B` SECTION
A-A` SECTION
HWL
4000
4500
6000
12000
39400
12300
6800
5000
D: DEPTH
RAW WATER INLET PIPE
MIXING BASIN
JICA
ATTACHED FIGURE 8.1.10 COAGULATION AND SEDIMENTATION TYPE A/B/C
THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN

WATER TREATMENT PLANT TYPE A

FILTRATION BASIN



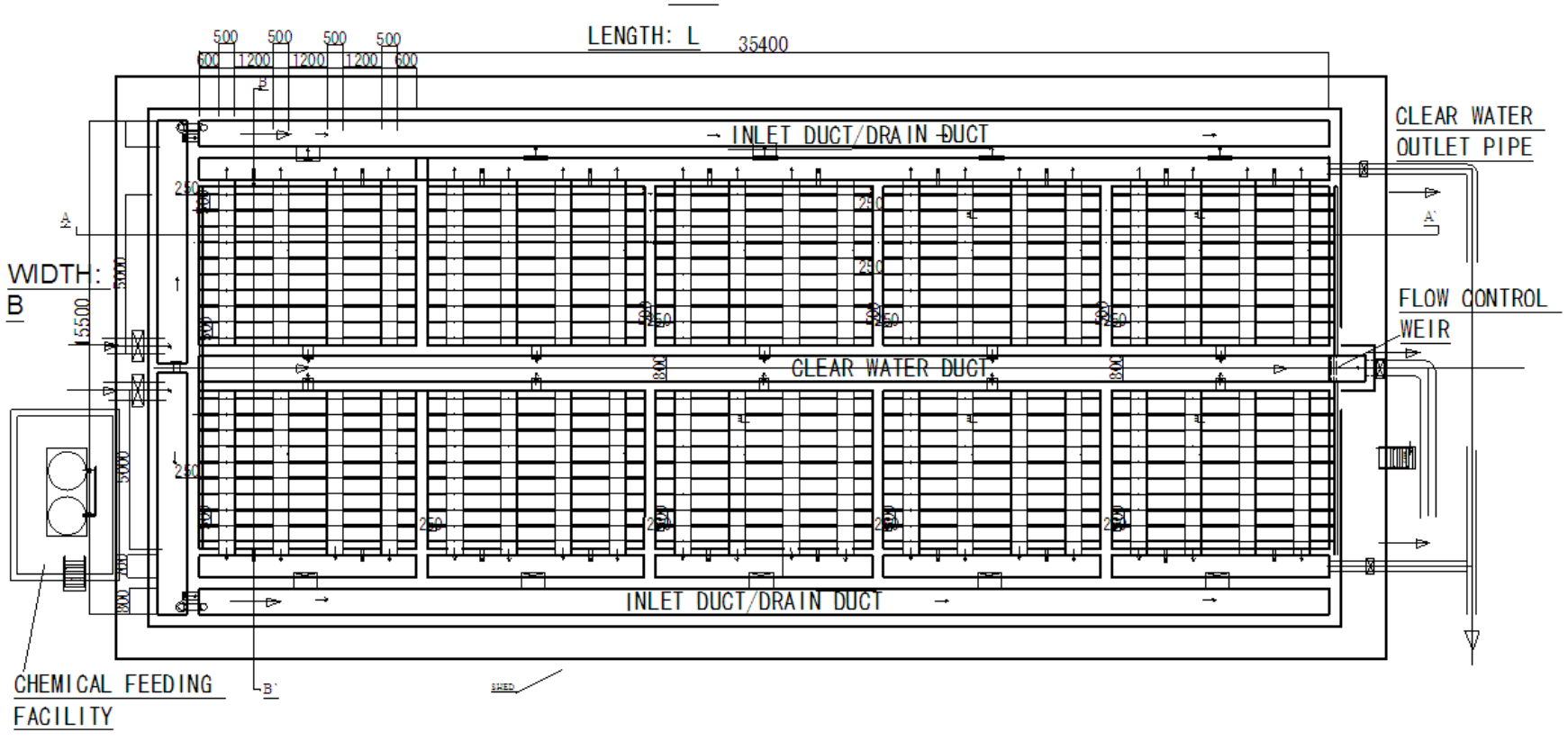


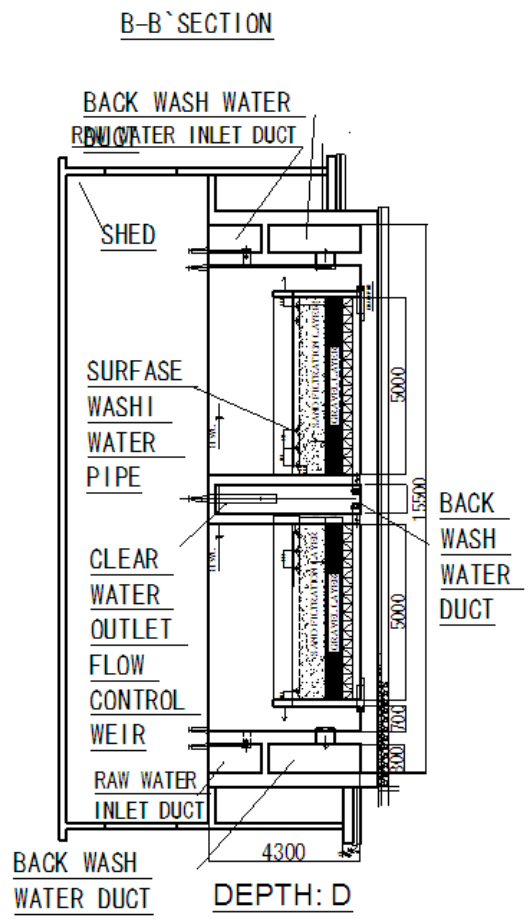
DEMENSION OF THIS DRAWING REFERS TO
THE FOLOWING CAPACITY
FILTRATION CAPACITY: MAX. 2,800m3/day
FILTRATION SPEED: MAX. 150m/day

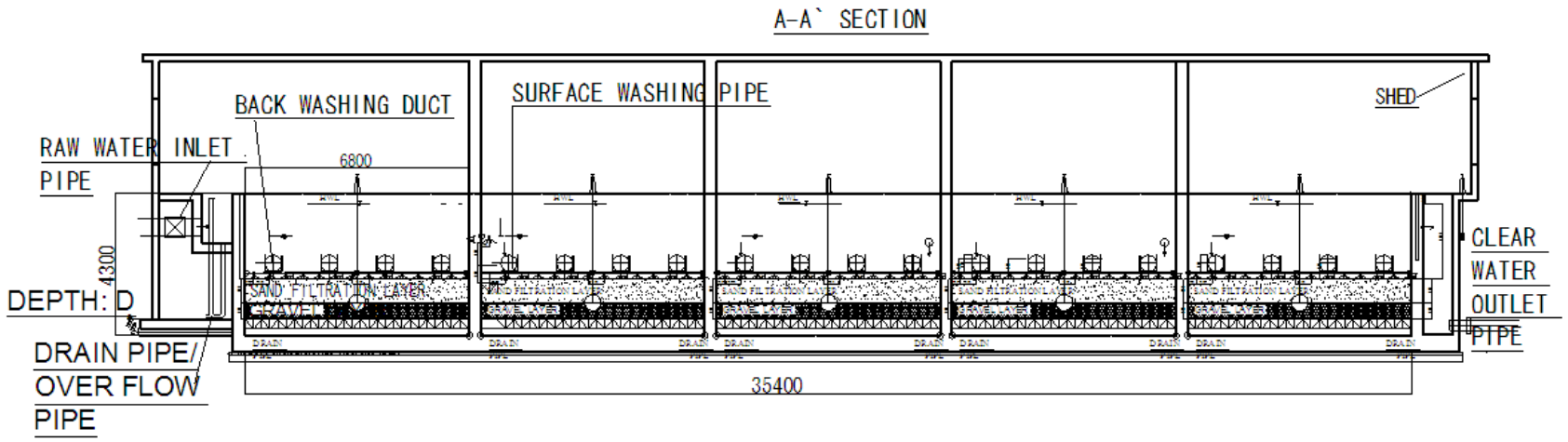
ATTACHED FIGURE 8.1.11 RAPID FILTRATION BASIN TYPE A AND B

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA

WATER TREATMENT PLANT TYPE C
FILTRATION BASIN







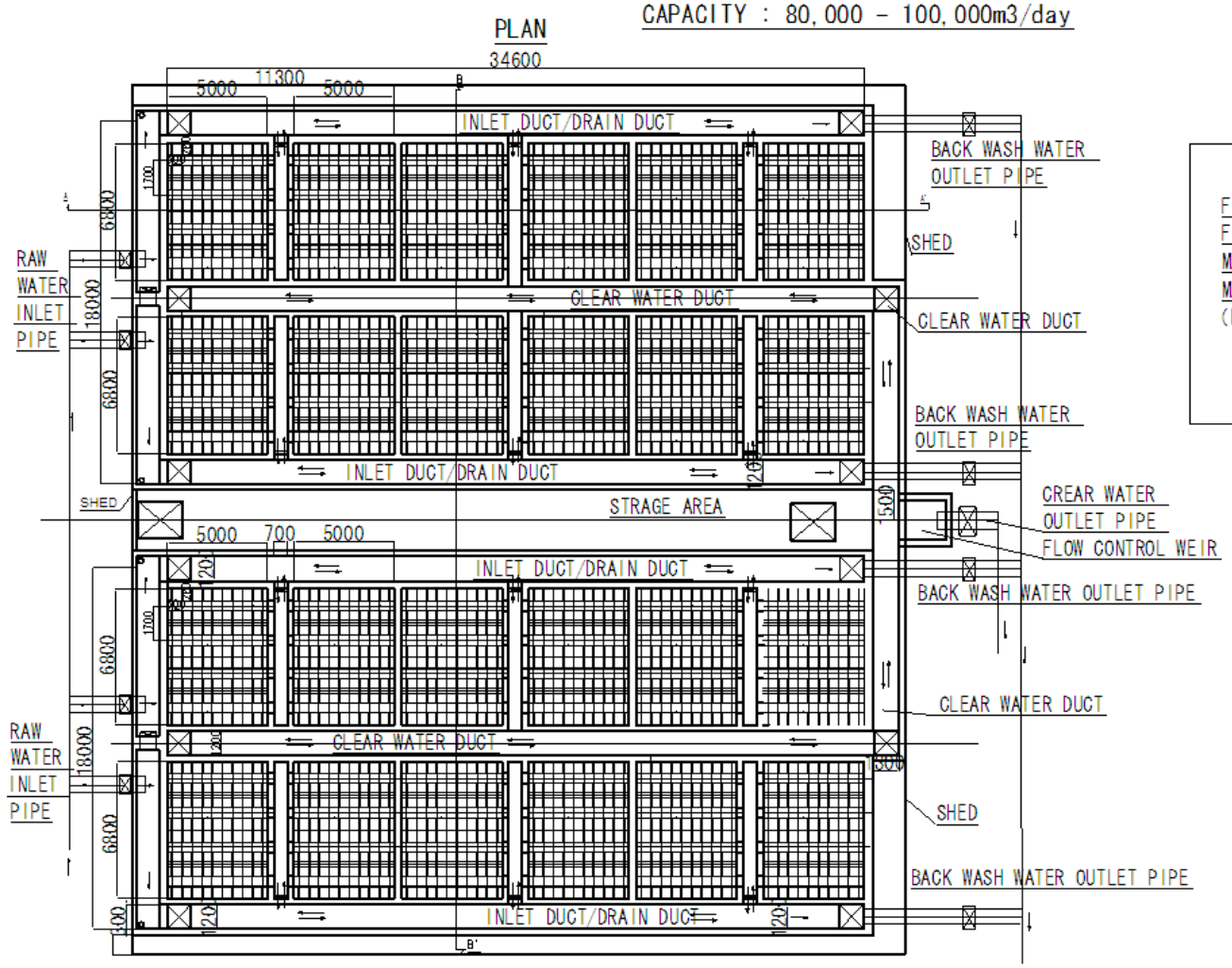
DEMENSION OF THIS DRAWING REFERS TO THE FOLLOWING CAPACITY
FILTRATION CAPACITY:
MAX. 40,000m3/day
FILTRATION SPEED: MAX. 150m/day

ATTACHED FIGURE 8.1.12 RAPID FILTRATION BASIN TYPE C

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA

RAPID FILTRATION BASIN TYPE D

CAPACITY : 80,000 - 100,000m3/day



FILTRATION CAPACITY:
FILTRATION SPEED: MAX. 150m/day
MAX. 10,200 m3/day x 10 BASIN=80,800m3/day
MAX. 10,200 m3/day x 12 BASIN=10,200m3/day
(Including 1Stunby Basin and 10 % of Stunby Capacity)

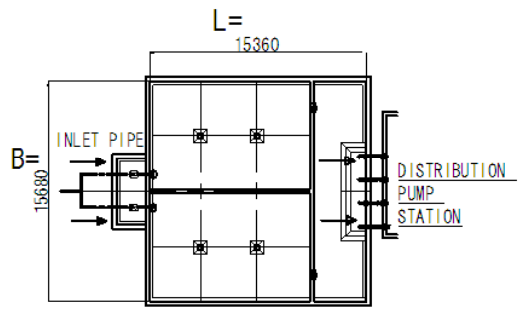
ATTACHED FIGURE 8.1.13 RAPID FILTRATION BASIN TYPE D

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA

WATER TRATMENT PLANT
TYPE A and TYPE C

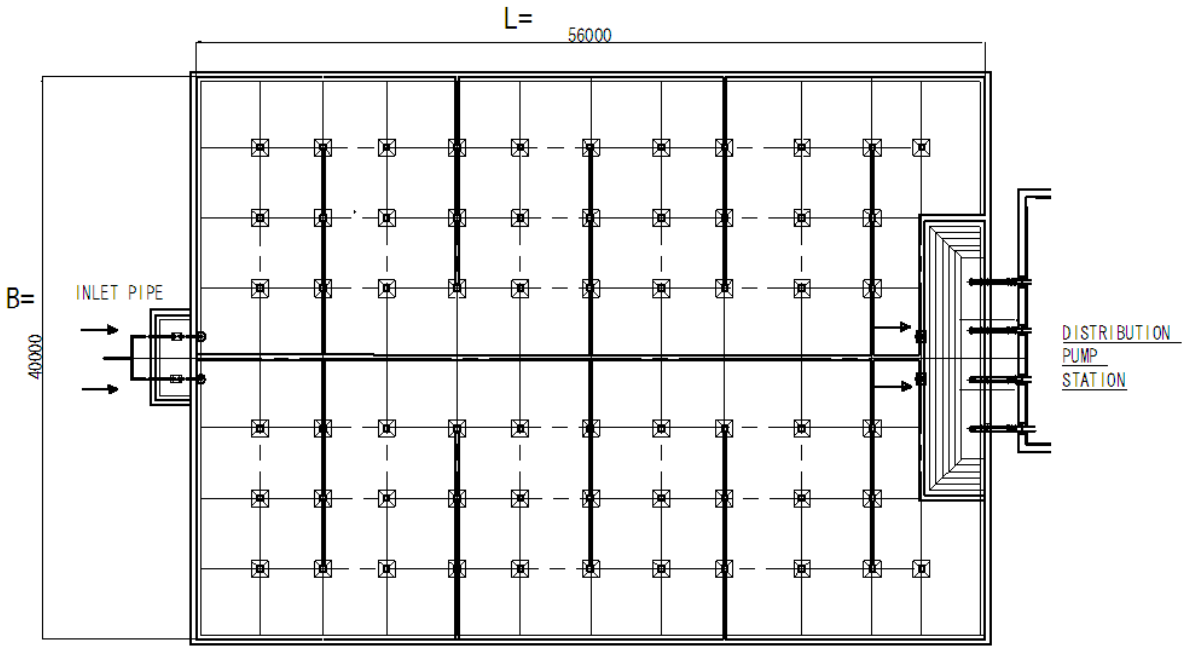
DISTRIBUTION RESERVOIR

TYPE A CAPACITY : 700m3



DISTRIBUTION RESERVOIR

TYPE C: CAPACITY=10,000m3



ATTACHED FIGURE 8.1.14 DISTRIBUTION RESERVOIR TYPE A/B AND C

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN | JICA

4 CHAPTER 9 REHABILITATION AND EXPANSION PLAN OF RURAL WATER SUPPLY SYSTEM

Attached Figures

(1) Results of Pumping Test
(2) Rehabilitation and Expansion Plan
(3) Design of Facility Structure

4 CHAPTER 9 REHABILITATION AND EXPANSION PLAN OF RURAL WATER SUPPLY SYSTEM

Attached Figures

(1) Results of Pumping Test

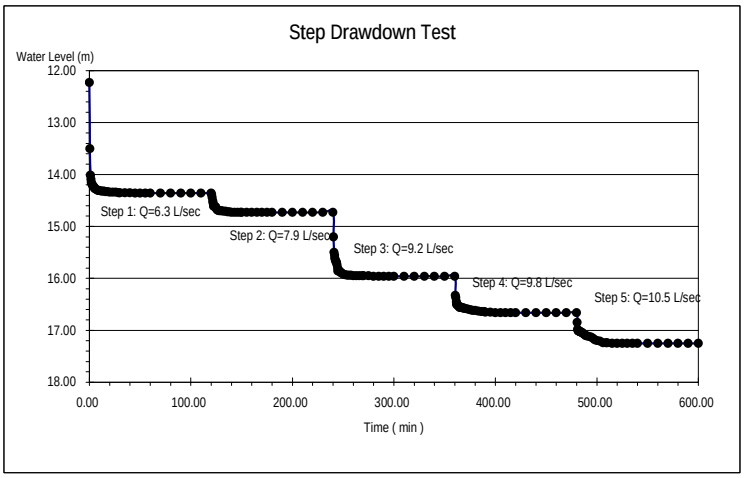
Result of the Pumping Test

Well Code: ***K-2*** Village Name: *Yangi Yul* S.W.L. : *12.23 m*

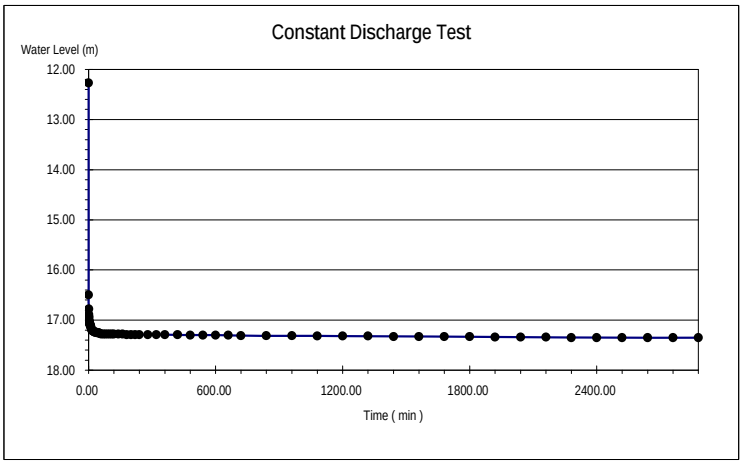
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	2.13
Step2	7.9	28.44	120	2.5
Step3	9.2	33.12	120	3.73
Step4	9.8	35.28	120	4.43
Step5	10.5	37.8	120	5.02

Q: Yield

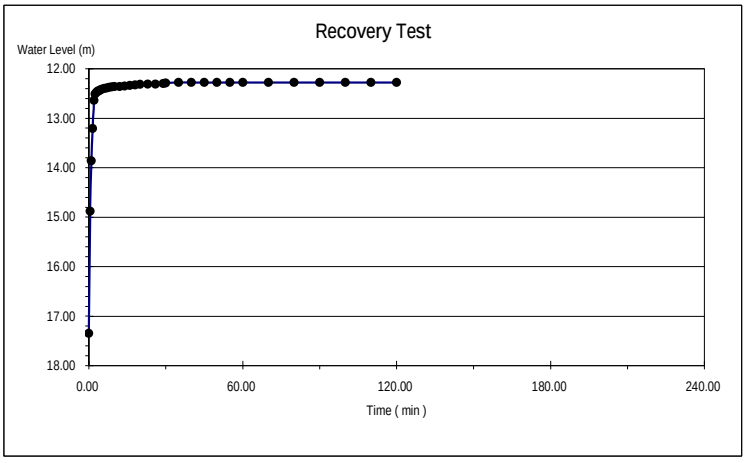
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	5.08	m



Recovery Test		
Static Water Level	12.23	m
Drawdown	5.08	m
SWL of 90% Recoveried	12.78	m
Recovering Time	2	min



Attached Figure-9.1 Result of Pumping Test (K-2)

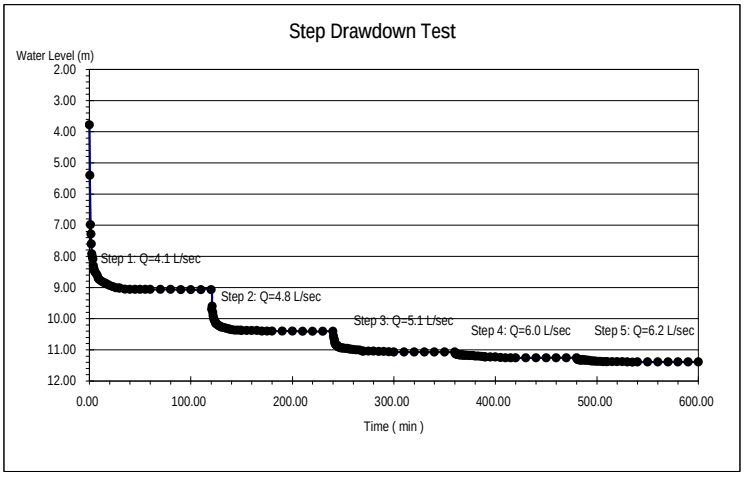
Result of the Pumping Test

Well Code: ***K-5*** Village Name: *Navruz* S.W.L. : *3.78 m*

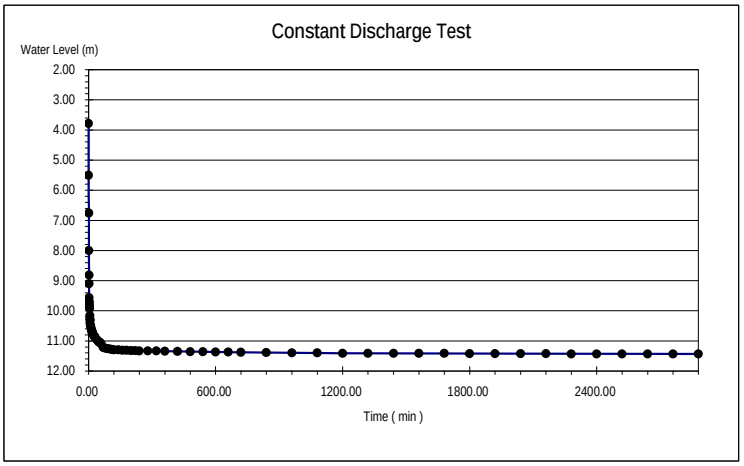
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	4.1	14.76	120	5.29
Step2	4.8	17.28	120	6.63
Step3	5.1	18.36	120	7.29
Step4	6	21.6	120	7.48
Step5	6.2	22.32	120	7.61

Q: Yield

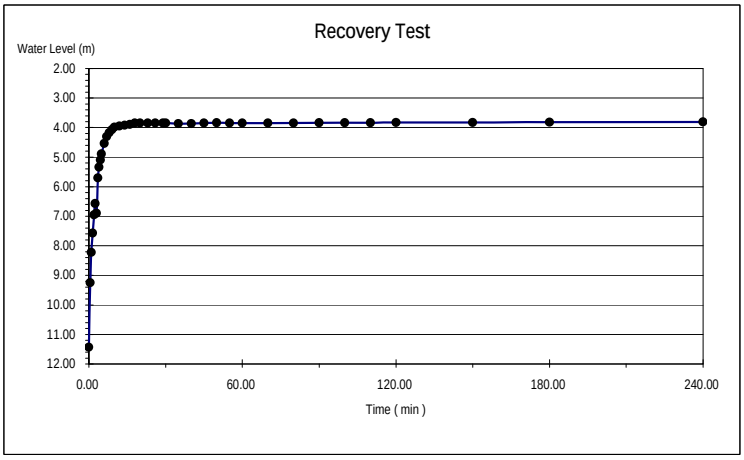
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	6.2	litter/sec
Drawdown	7.65	m



Recovery Test		
Static Water Level	3.78	m
Drawdown	7.65	m
SWL of 90% Recoveried	4.55	m
Recovering Time	6	min



Attached Figure-9.2 Result of Pumping Test (K-5)

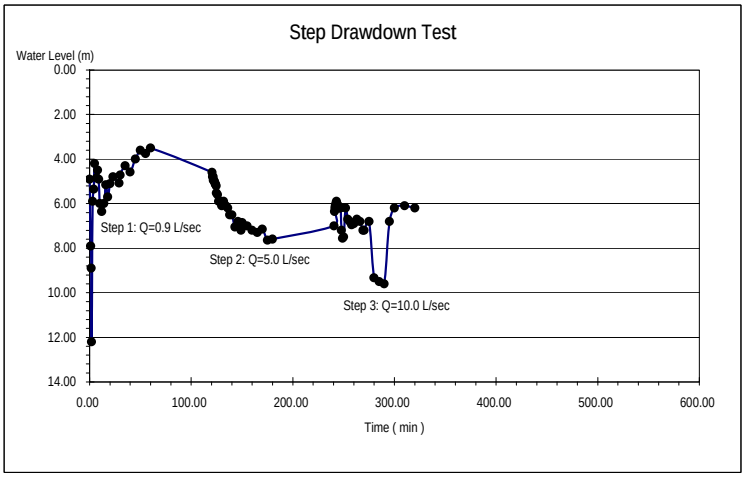
Result of the Pumping Test

Well Code: ***K-9*** Village Name: *Kabla* S.W.L. : *4.90 m*

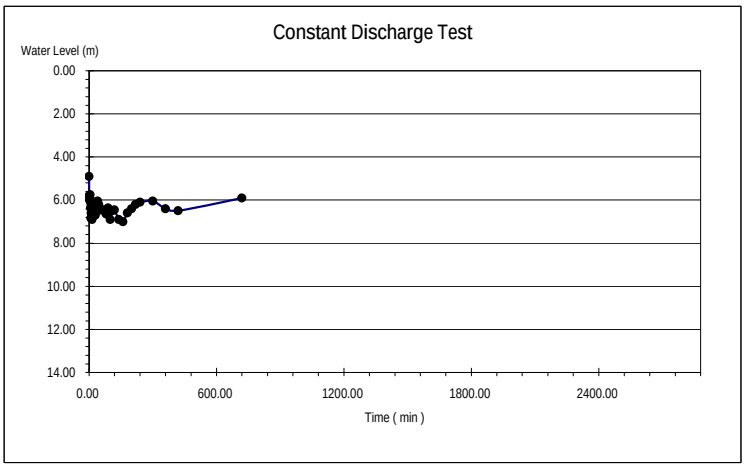
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	0.9	3.24	120	0.2
Step2	5	18	120	1
Step3	10	36	120	2.3
Step4				
Step5				

Q: Yield

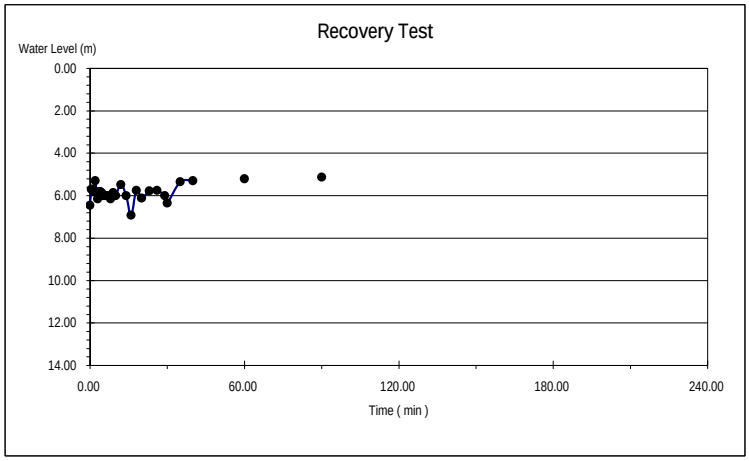
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	12	hours
Yield	10	litter/sec
Drawdown	2	m



Recovery Test		
Static Water Level	4.9	m
Drawdown	2	m
SWL of 90% Recoveried	5.2	m
Recovering Time	60	min



Attached Figure-9.3 Result of Pumping Test (K-9)

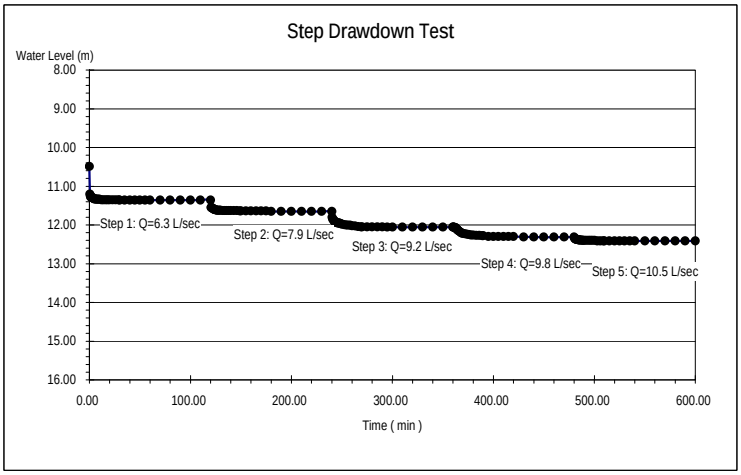
Result of the Pumping Test

Well Code: ***K-11*** Village Name: *Borshevik* S.W.L. : *10.49 m*

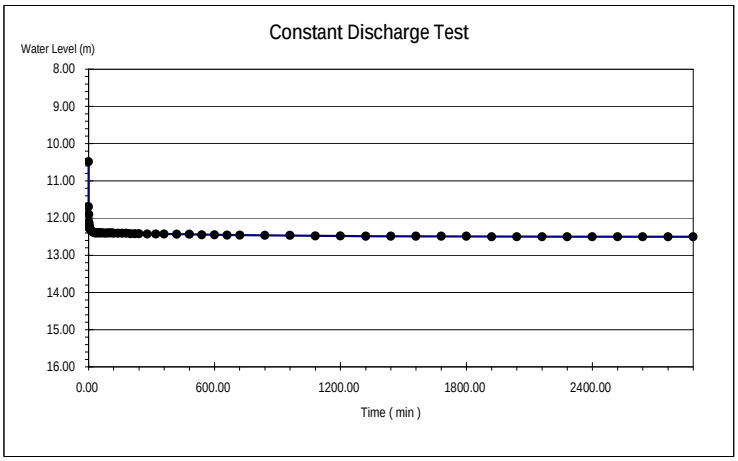
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	0.87
Step2	7.9	28.44	120	1.16
Step3	9.2	33.12	120	1.57
Step4	9.8	35.28	120	1.82
Step5	10.5	37.8	120	1.92

Q: Yield

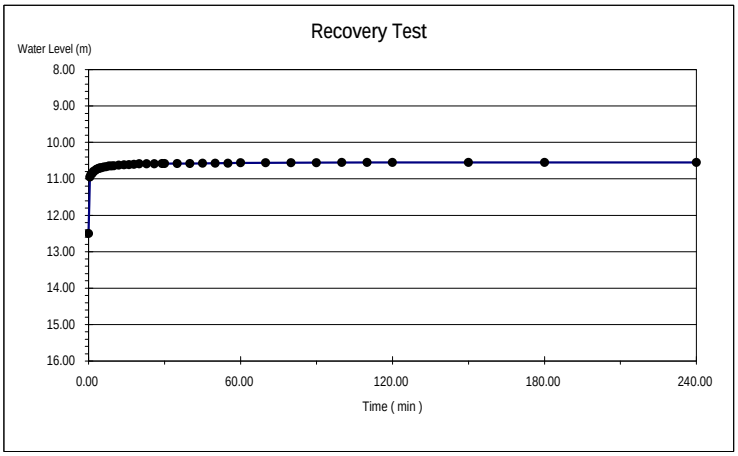
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	2.01	m



Recovery Test		
Static Water Level	10.49	m
Drawdown	12.5	m
SWL of 90% Recoveried	10.69	m
Recovering Time	6	min



Attached Figure-9.4 Result of Pumping Test (K-11)

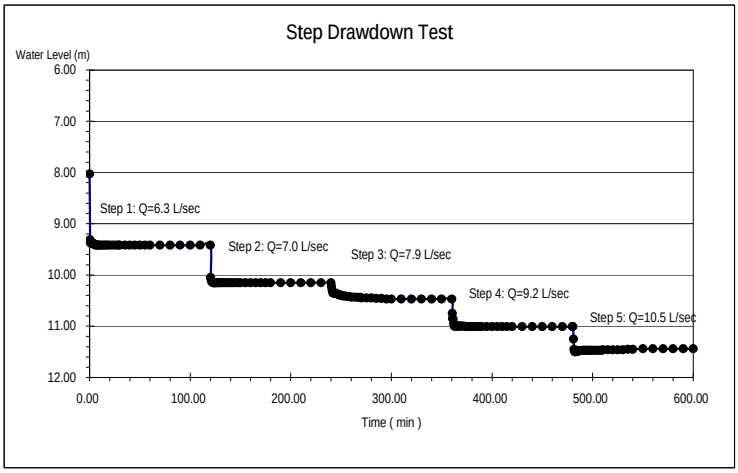
Result of the Pumping Test

Well Code: ***N-1*** Village Name: *44-Chashma* S.W.L. : *8.00 m*

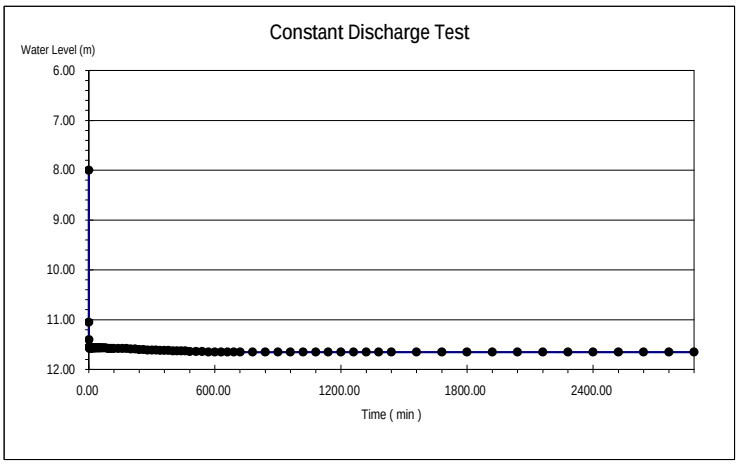
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	1.42
Step2	7	25.2	120	2.15
Step3	7.9	28.44	120	2.47
Step4	9.2	33.12	120	3.01
Step5	10.5	37.8	120	3.44

Q: Yield

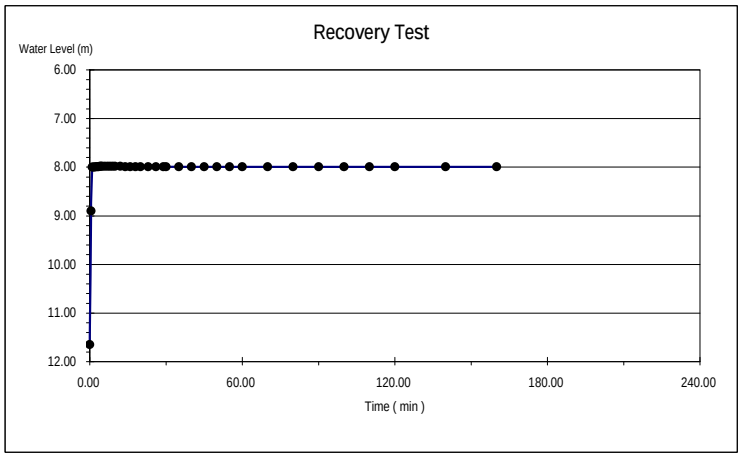
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	3.65	m



Recovery Test		
Static Water Level	8	m
Drawdown	3.65	m
SWL of 90% Recoveried	8.37	m
Recovering Time	1	min



Attached Figure-9.5 Result of Pumping Test (N-1)

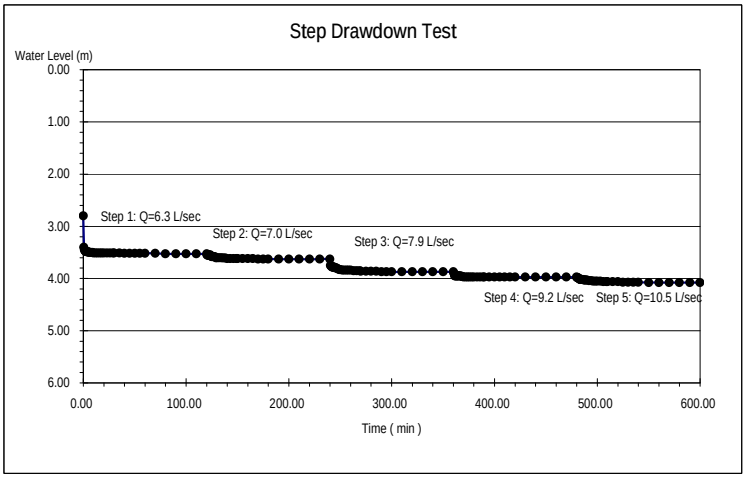
Result of the Pumping Test

Well Code: ***S-4*** Village Name: *Vatan* S.W.L. : *2.80 m*

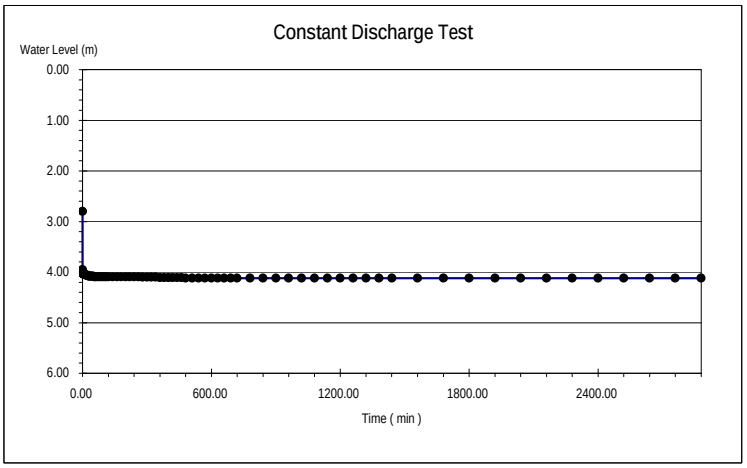
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	0.73
Step2	7	25.2	120	0.83
Step3	7.9	28.44	120	1.07
Step4	9.2	33.12	120	1.17
Step5	10.5	37.8	120	1.28

Q: Yield

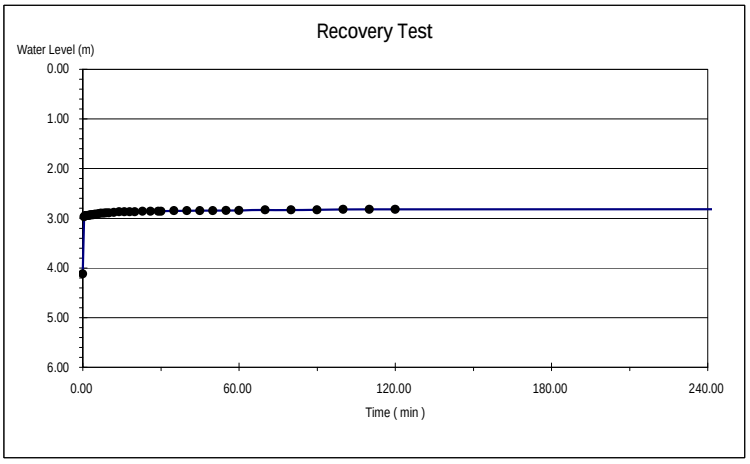
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	1.32	m



Recovery Test		
Static Water Level	2.8	m
Drawdown	1.32	m
SWL of 90% Recoveried	2.93	m
Recovering Time	3	min



Attached Figure-9.6 Result of Pumping Test (S-4)

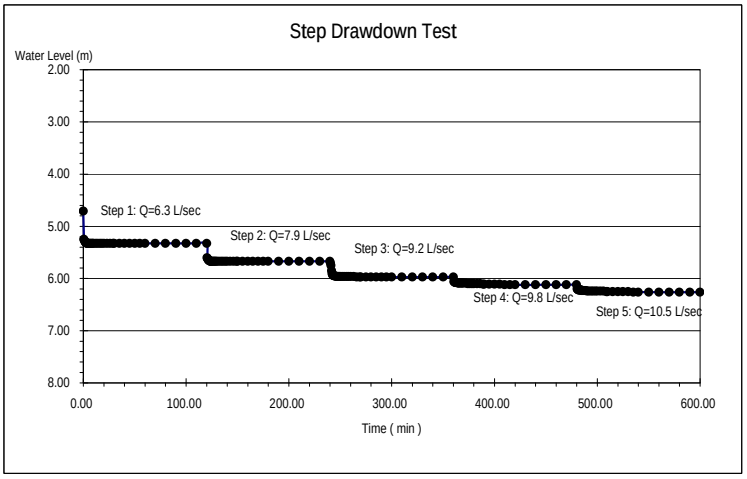
Result of the Pumping Test

Well Code: ***S-5*** Village Name: *Sultanabod* S.W.L. : *4.72 m*

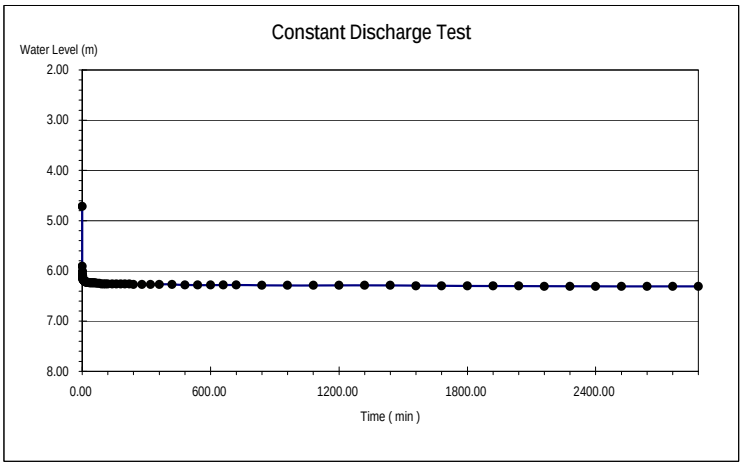
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	0.62
Step2	7.9	28.44	120	0.96
Step3	9.2	33.12	120	1.26
Step4	9.8	35.28	120	1.41
Step5	10.5	37.8	120	1.55

Q: Yield

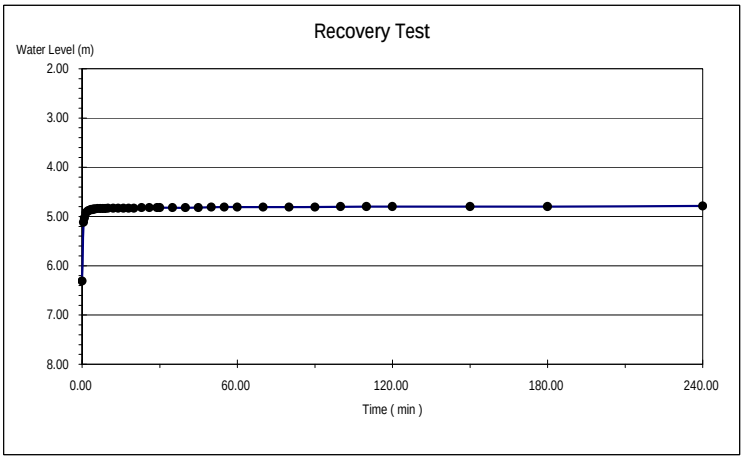
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	1.59	m



Recovery Test		
Static Water Level	4.72	m
Drawdown	1.59	m
SWL of 90% Recoveried	4.88	m
Recovering Time	2.5	min



Attached Figure-9.7 Result of Pumping Test (S-5)

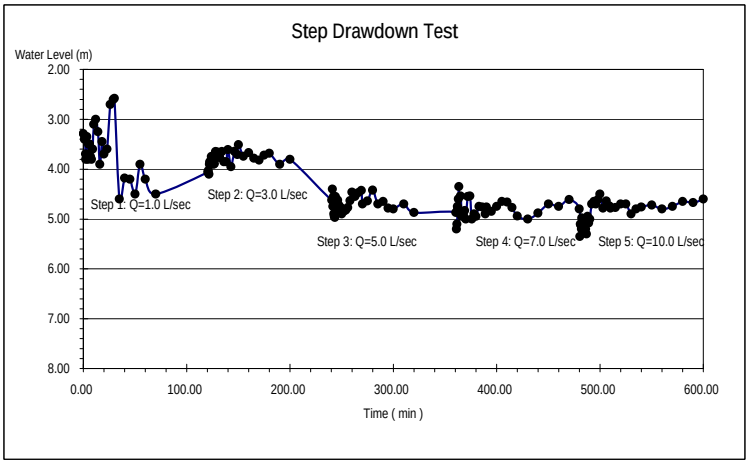
Result of the Pumping Test

Well Code: ***S-9*** Village Name: *Binokor* S.W.L. : *3.29 m*

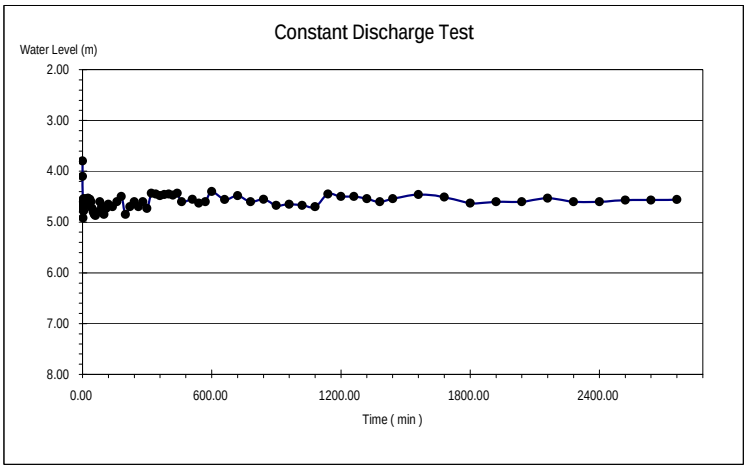
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	1	3.6	120	0.21
Step2	3	10.8	120	0.53
Step3	5	18	120	1.35
Step4	7	25.2	120	1.46
Step5	10	36	120	1.51

Q: Yield

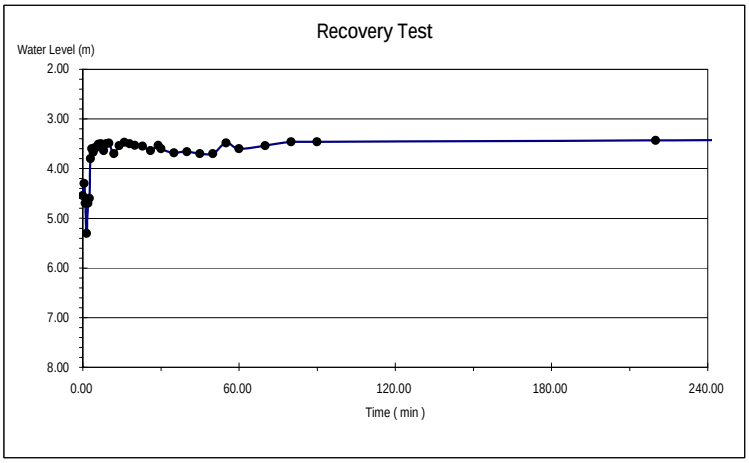
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10	litter/sec
Drawdown	1.28	m



Recovery Test		
Static Water Level	3.29	m
Drawdown	1.28	m
SWL of 90% Recoveried	3.6	m
Recovering Time	4	min



Attached Figure-9.8 Result of Pumping Test (S-9)

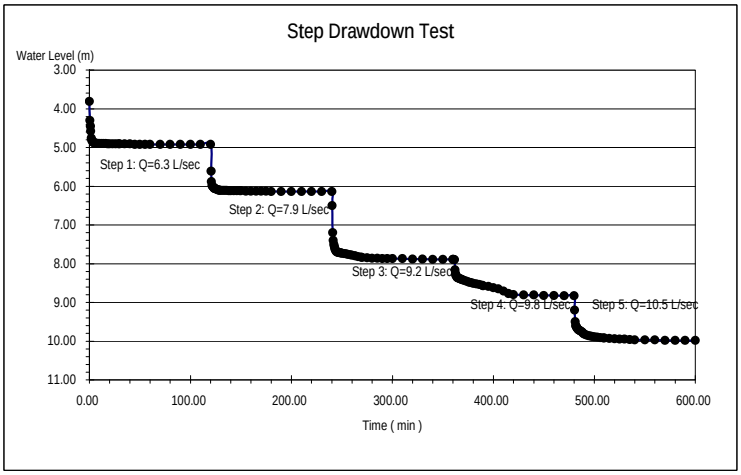
Result of the Pumping Test

Well Code: ***P-13*** Village Name: *Sarmantoy* S.W.L. : *3.85 m*

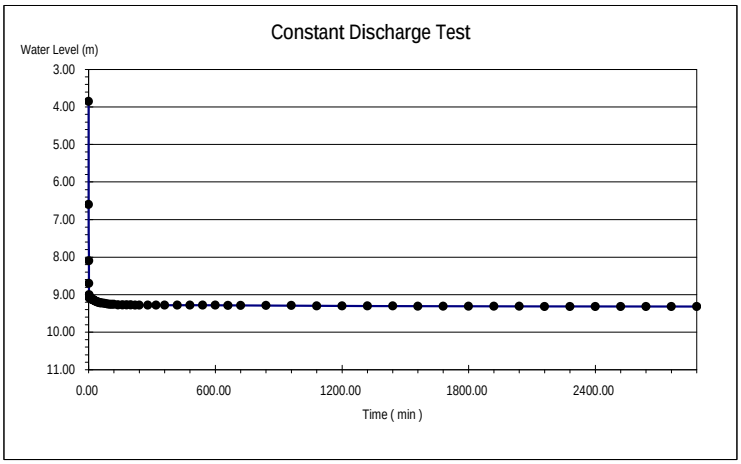
Step Drawdown Test				
No.	Q l/sec	Q m3/h	Time min	DD m
Step1	6.3	22.68	120	1.11
Step2	7.9	28.44	120	2.33
Step3	9.2	33.12	120	4.08
Step4	9.8	35.28	120	5.02
Step5	10.5	37.8	120	6.17

Q: Yield

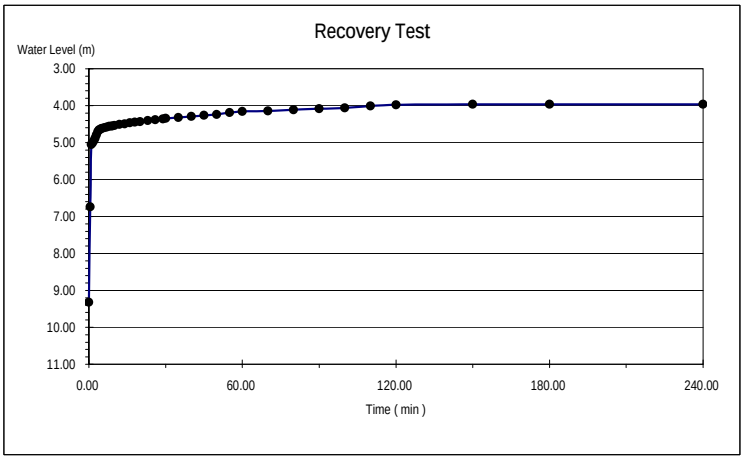
DD: Drawdown against the yield



Constant Discharge Test		
Continuance	48	hours
Yield	10.5	litter/sec
Drawdown	5.47	m



Recovery Test		
Static Water Level	3.85	m
Drawdown	5.47	m
SWL of 90% Recoveried	4.4	m
Recovering Time	23	min



Attached Figure-9.9 Result of Pumping Test (P-13)

4 CHAPTER 9 REHABILITATION AND EXPANSION PLAN OF RURAL WATER SUPPLY SYSTEM

Attached Figures
(2) Rehabilitation and Expansion Plan

Rehabiliation Plan of Water Supply System

K-2		Rayon	**Kabodiyon**	Population (2007)	**3618**
Yangi Yul		Jamoat	**S. Khudoikulov**	Population (2015)	**4342**
		Village	**Yangi Yul**		

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	87 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	13 m3/day	20 m3/h			
Total Water Demand	100 m3/day			No. of Distribution Tank	
Daily Average Flow	120 m3/day	Distribution Flow		60m3 Elevated Tank x 1	
Daily Maximum Flow	120 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	20 m3/h		Public Water Tap	
Hourly Maximum Flow	20 m3/h			83 nos.	0.241 m3/h

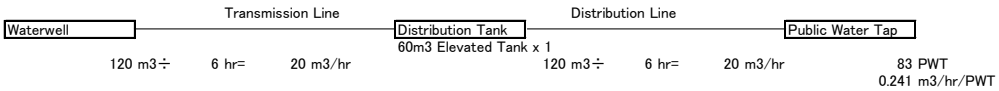
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3 ϕ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	67 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	20 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	5.5 kw	Power	Power
Well Depth:	80 m	Max. Diameter	142 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	20 m3/h				
Well Casing:	6"PVC				

Distribution Tank

No. of Tank	60m3 Elevated Tank x 1
Height of Tank	10 m

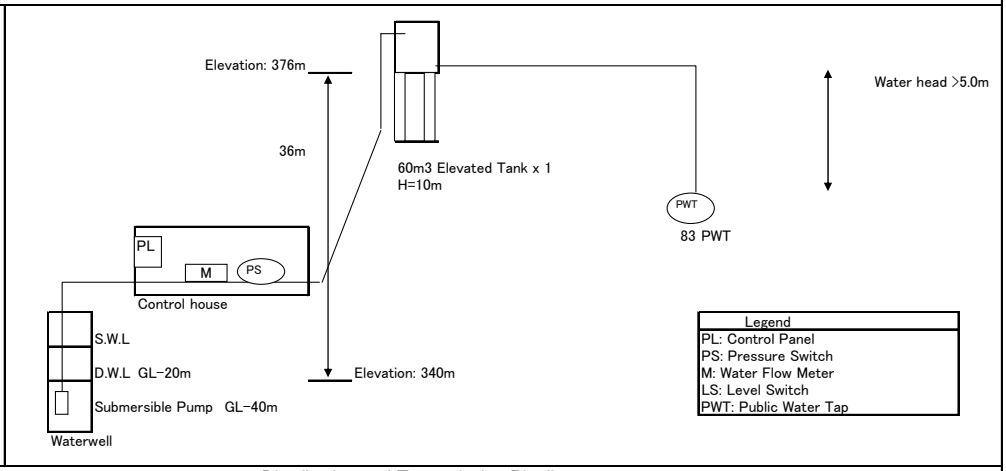
Water Supply Flow Chart



Population
4342

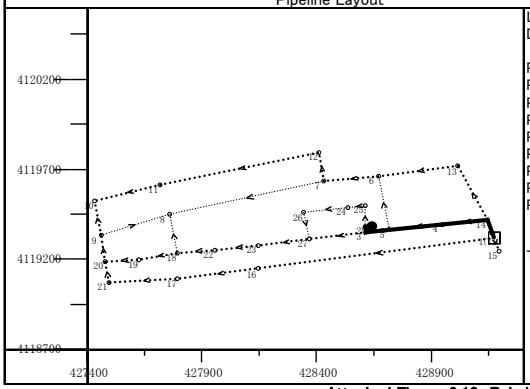
Distribution Flow
20m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	2,081			2,081
PN75	61.4				
PN90	73.6	6,139			6,139
PN110	90				
PN125	102.2				
PN140	114.6		710		710
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2"	50				
SUS2-1/2"	65			40	40
SUS3"	75				
Total		8,220	710	40	8,970

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.10 Rehabilitation and Extension Plan (K-2 Yangi Yul)

Rehabiliation Plan of Water Supply System

K-5	Rayon	**Kabodiyon**	Population (2007)	**820**	
Navruz	Jamoat	**Navobod**	Population (2015)	**984**	
	Village	**Navruz**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	20 m3/day	(=Daily Maixmum Flow / Operation Housrs) :			1
Institutional Water Demand	3 m3/day	4.7 m3/h		No. of Distribution Tank	
Total Water Demand	23 m3/day			20m3 Elevated Tank x 1	
Daily Average Flow	28 m3/day	Distribution Flow			
Daily Maximum Flow	28 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	4.7 m3/h		Public Water Tap	
Hourly Maximum Flow	4.7 m3/h			10 nos.	0.47 m3/h

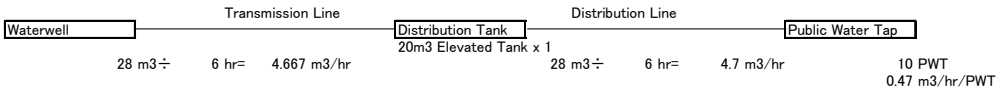
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	18 m3/h	Pump Head	70 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	4.7 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	1.5 kw	Power	Power
Well Depth:	100 m	Max. Diameter	98 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	4.7 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	20m3 Elevated Tank x 1
Height of Tank	10 m

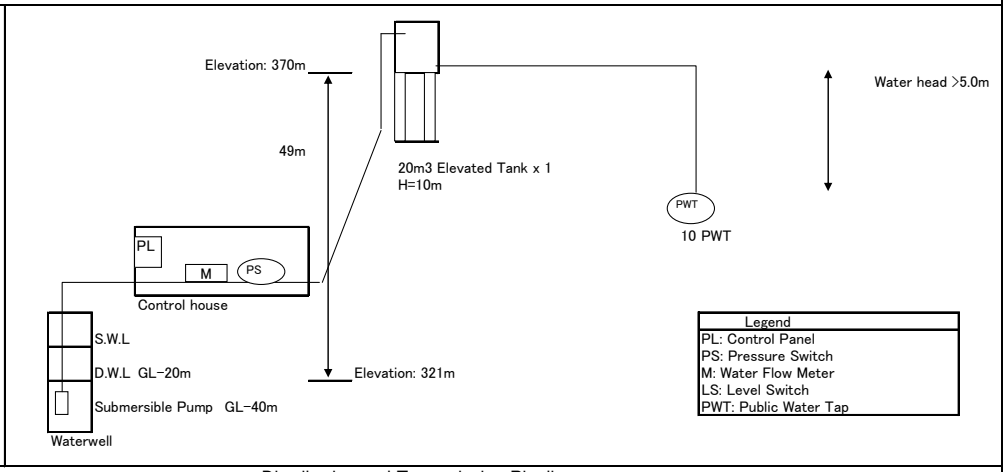
Water Supply Flow Chart



Population
984

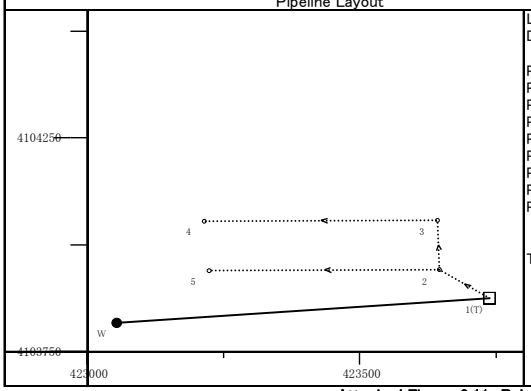
Distribution Flow
4.7m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63 ·····
PN75 ·····
PN90 ·····
PN110 ····
PN125 ····
PN140 •••
PN160 •••
PN180 •••
PN200 ••
Transmission PL
● Waterwell
□ Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4				
PN75	61.4	1,079	700		1,779
PN90	73.6				
PN110	90				
PN125	102.2				
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50			40	40
SUS2-1/2″	65				
SUS3″	75				
Total		1,079	700	40	1,819

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.11 Rehabilitation and Extension Plan (K-5 Navrus)

Rehabiliation Plan of Water Supply System

K-7 **Jarkurgan**		Rayon Jamoat Village	**Kabodiyon** **S. Khudoikulov** **Jarkurgan**	Population (2007) Population (2015)	**3917** **4700**

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	94 m3/day	(=Daily Maixmum Flow / Operation Housrs) :			1
Institutional Water Demand	14 m3/day		21.7 m3/h		
Total Water Demand	108 m3/day			No. of Distribution Tank	
Daily Average Flow	130 m3/day	Distribution Flow			70m3 Elevated Tank x 1
Daily Maximum Flow	130 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr		21.7 m3/h	Public Water Tap	
Hourly Maximum Flow	21.7 m3/h				117 nos. 0.185 m3/h

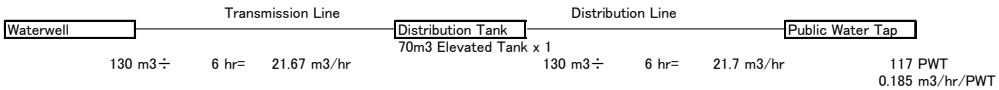
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	73 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	21.7 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	7.5 kw	Power	Power
Well Depth:	80 m	Max. Diameter	142 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	21.7 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	70m3 Elevated Tank x 1
Height of Tank	10 m

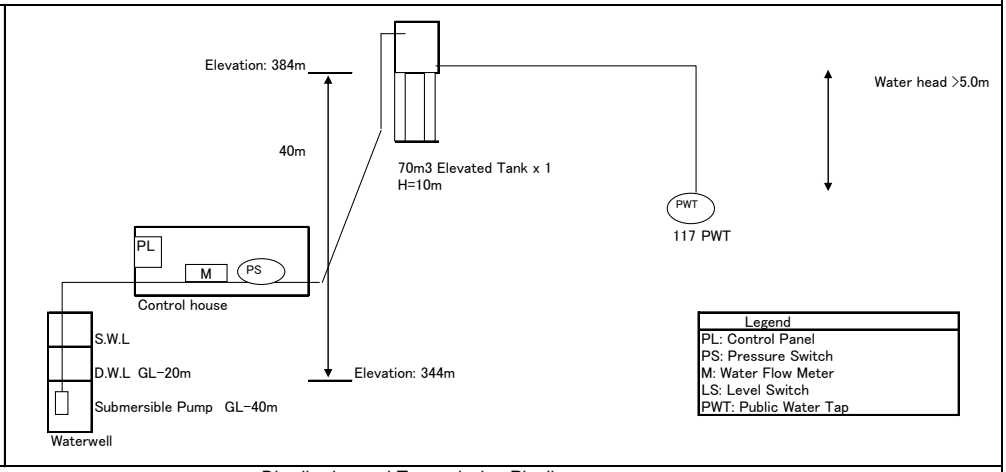
Water Supply Flow Chart



Population
4700

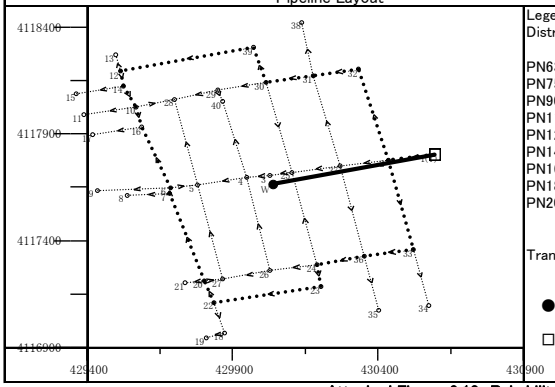
Distribution Flow
21.7m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	7,136			7,136
PN75	61.4				
PN90	73.6				
PN110	90				
PN125	102.2	3,783			3,783
PN140	114.6	162	588		750
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			40	40
SUS3″	75				
Total		11,081	588	40	11,709

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.12 Rehabilitation and Extension Plan (K-7 Jarkurgan)

Rehabiliation Plan of Water Supply System

K-9-1	Rayon	**Kabodiyon**	Population (2007)	**6180**	
Kabla	Jamoat	**S. Nazarov**	Population (2015)	**7416**	
	Village	**Kabla**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	148 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	22 m3/day	34 m3/h			
Total Water Demand	170 m3/day			No. of Distribution Tank	
Daily Average Flow	204 m3/day	Distribution Flow		100m3 Elevated Tank x 1	
Daily Maximum Flow	204 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	34 m3/h		Public Water Tap	
Hourly Maximum Flow	34 m3/h			122 nos.	0.279 m3/h

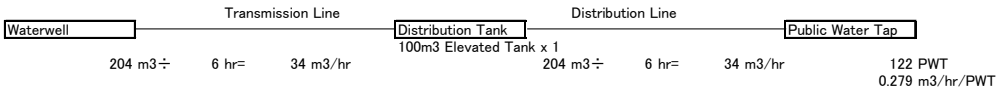
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	40 m3/h	Pump Head	58 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	34 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	9.2 kw	Power	Power
Well Depth:	80 m	Max. Diameter	145 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	63 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	34 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	100m3 Elevated Tank x 1
Height of Tank	10 m

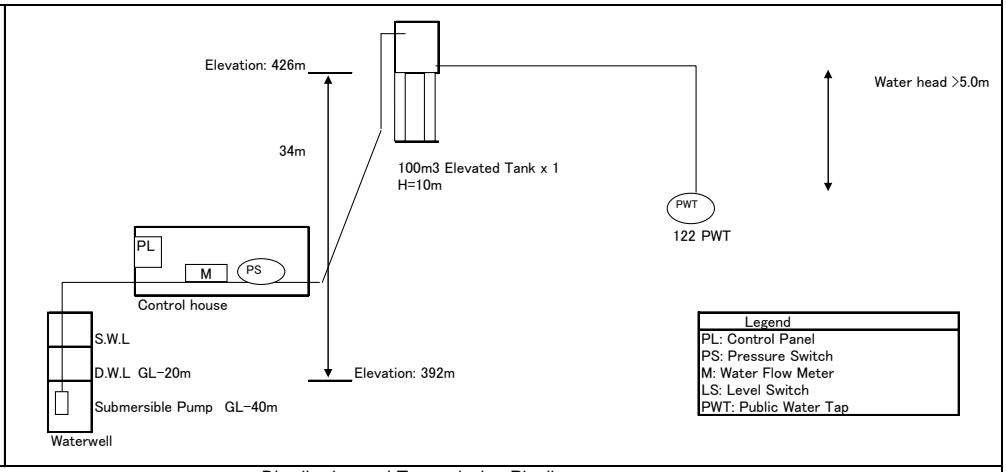
Water Supply Flow Chart



Population
7416

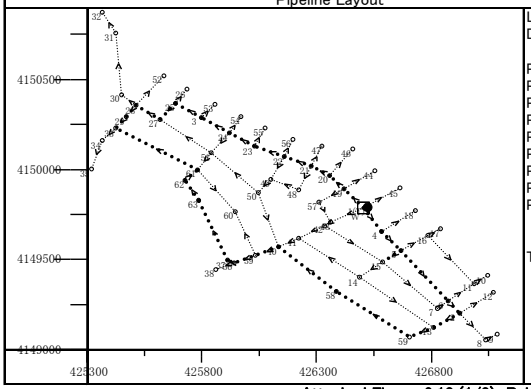
Distribution Flow
34m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	8,183			8,183
PN75	61.4				
PN90	73.6				
PN110	90				
PN125	102.2	4,485			4,485
PN140	114.6				
PN160	130.8				
PN180	147.2		34		34
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			40	40
SUS3″	75				
Total		12,668	34	40	12,742

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.13 (1/2) Rehabilitation and Extension Plan (K-9 (1/2) Kabla)

Rehabiliation Plan of Water Supply System

K-9-2	Rayon	**Kabodiyon**	Population (2007)	**11384**	
Boshkala	Jamoat	**S. Nazarov**	Population (2015)	**13661**	
	Village	**Kabla**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	273 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		3	
Institutional Water Demand	41 m3/day	62.8 m3/h			
Total Water Demand	314 m3/day			No. of Distribution Tank	
Daily Average Flow	377 m3/day	Distribution Flow		100m3 Elevated Tank x 1 (T1) and 100m3 x 1 (T	
Daily Maximum Flow	377 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	62.8 m3/h		Public Water Tap	
Hourly Maximum Flow	62.8 m3/h			300 nos.	0.209 m3/h

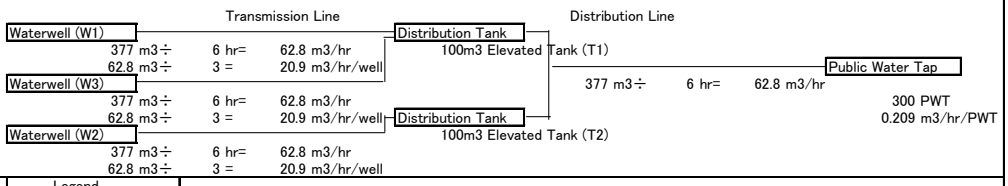
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2		Well Pump 3	
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	380V x 3φ, 50Hz	Type	380V x 3φ, 50Hz
Well Capacity:	22 m3/h	Pump Head	55 m	Pump Head	55 m	Pump Head	73 m
Dyanamic Water Level:	20 m	Discharge Rate	20.9 m3/h	Discharge Rate	20.9 m3/h	Discharge Rate	20.9 m3/h
Pump Instation Depth:	40 m	Power	5.5 kw	Power	5.5 kw	Power	7.5 kw
Well Depth:	80 m	Max. Diameter	142 mm	Max. Diameter	142 mm	Max. Diameter	142 mm
Operation Hour:	6 hr	Transformer	25 kw	Transformer	25 kw	Transformer	25 kw
No. of Waterwell:	3 no.	Riser Pipe:	SUS	Riser Pipe:	SUS	Riser Pipe:	SUS
Pumping Rate per well:	20.9 m3/h						
Well Casing:	6″PVC						

Distribution Tank

No. of Tank	100m3 Elevated Tank x 1 (T1) and 100m3 x 1 (T2)
Height of Tank	10 m

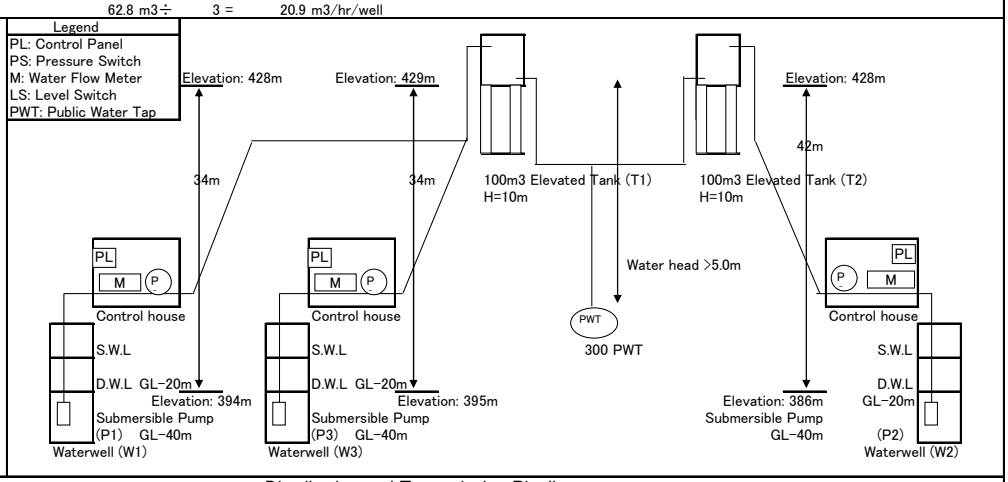
Water Supply Flow Chart



Population 13661

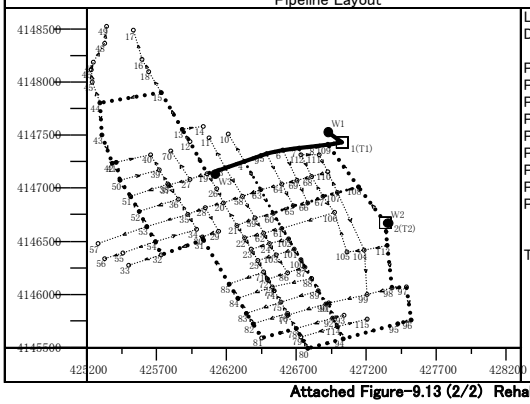
Distribution Flow 20.9m3/h

Unit Water Demand 20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	19,754			19,754
PN75	61.4				
PN90	73.6				
PN110	90	2,547			2,547
PN125	102.2				
PN140	114.6	8,295	1,187		9,482
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			120	120
SUS3″	75				
Total		30,596	1,187	120	31,903

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.13 (2/2) Rehabilitation and Extension Plan (K-9 (2/2) Boshkala)

Rehabiliation Plan of Water Supply System

K-11	Rayon	**Kabodiyon**	Population (2007)	**3816**
Bolshevik	Jamoat	**S. Khudoikulov**	Population (2015)	**4579**
	Village	**Bolshevik**		

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	92 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	14 m3/day	21.2 m3/h			
Total Water Demand	106 m3/day			No. of Distribution Tank	
Daily Average Flow	127 m3/day	Distribution Flow		70m3 Elevated Tank x 1	
Daily Maximum Flow	127 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	21.2 m3/h		Public Water Tap	
Hourly Maximum Flow	21.2 m3/h			103 nos.	0.206 m3/h

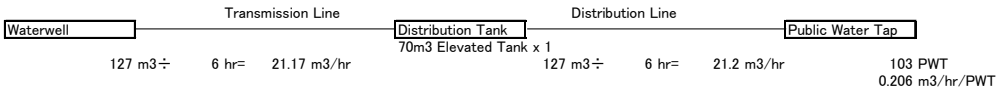
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	100 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	21.2 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	9.2 kw	Power	Power
Well Depth:	80 m	Max. Diameter	142 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	63 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	21.2 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	70m3 Elevated Tank x 1
Height of Tank	10 m

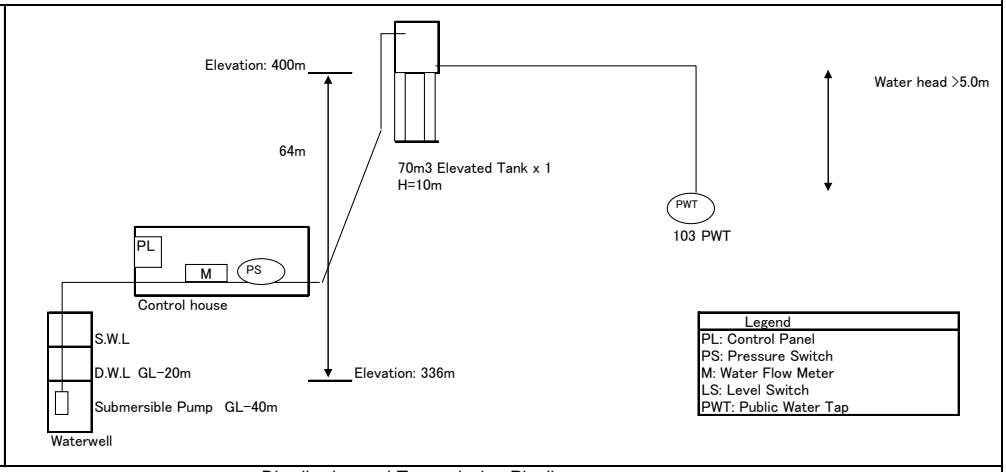
Water Supply Flow Chart



Population
4579

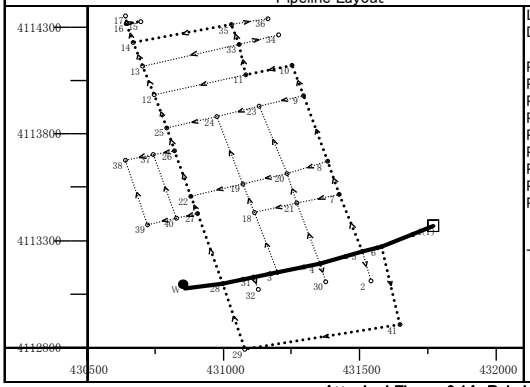
Distribution Flow
21.2m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	5,780			5,780
PN75	61.4				
PN90	73.6				
PN110	90	4,361			4,361
PN125	102.2	213			213
PN140	114.6		998		998
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			40	40
SUS3″	75				
Total		10,354	998	40	11,392

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.14 Rehabilitation and Extension Plan (K-11 Bolshevik)

Rehabiliation Plan of Water Supply System

N-1-1	Rayon	**Nosiri-Khisrav**	Population (2007)	**1500**	
Oltinsoy	Jamoat	**Istiklol**	Population (2015)	**1800**	
	Village	**Oltinsoy**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	36 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		0	
Institutional Water Demand	5 m3/day	8.2 m3/h			
Total Water Demand	41 m3/day			No. of Distribution Tank	
Daily Average Flow	49 m3/day	Distribution Flow		30m3 Elevated Tank x 1	
Daily Maximum Flow	49 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	8.2 m3/h		Public Water Tap	
Hourly Maximum Flow	8.2 m3/h			98 nos.	0.084 m3/h

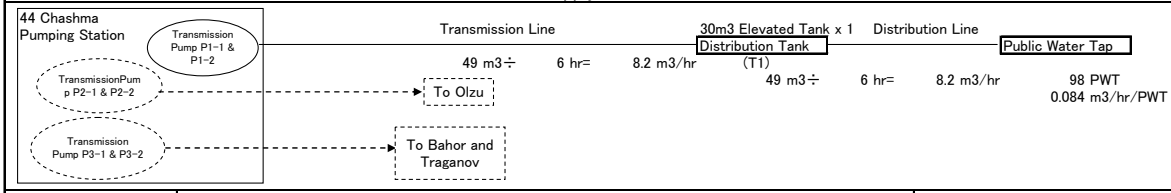
Rehabilitation Plan

Water Source		Transmission Pump (Centrifugal Pump)			
Type of Water Source:		Type	380V x 3ϕ, 50Hz	No. of Pump:	2 pumps for duplex system (P1-1 and P1-2)
44 Chashma Pumping Station		Pump Head	55 m	Transformer	63 kw
(From Existing Waterwell and Reservoir)		Discharge Rate	8.2 m3/h		(1 Transformer for P1, P2 and P3)
Discharge Rate:	8.2 m3/h	Power	2.2 kw		

Distribution Tank

No. of Tank	30m3 Elevated Tank x 1
Height of Tank	10 m

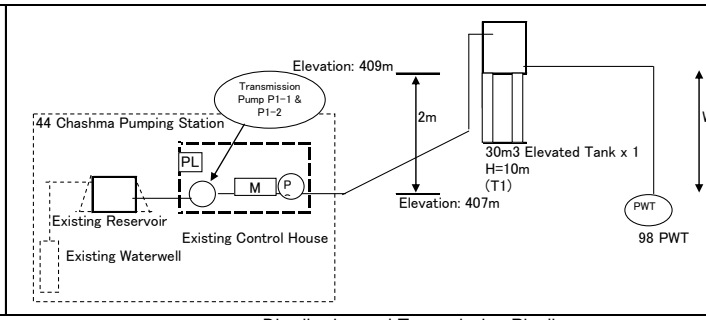
Water Supply Flow Chart



Population 1800

Distribution Flow 8.2m3/h

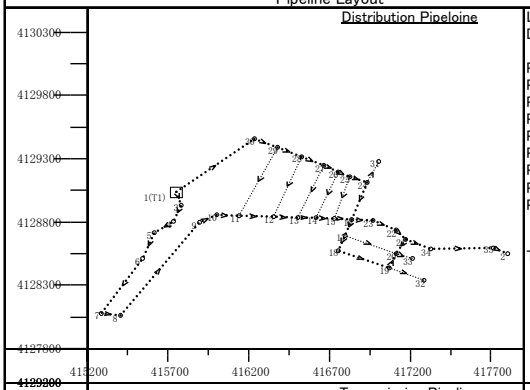
Unit Water Demand 20 L/day/capita



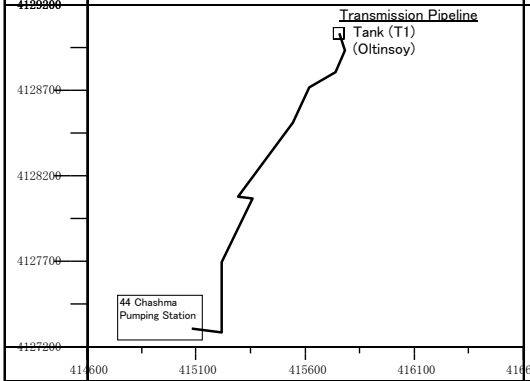
Legend
PL: Control Panel
PS: Pressure Switch
M: Water Flow Meter
LS: Level Switch
PWT: Public Water Tap

Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	3,138			3,138
PN75	61.4				
PN90	73.6	6,698	2,142		8,840
PN110	90				
PN125	102.2				
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65				
SUS3″	75				
Total		9,836	2,142		11,978

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.15(1/4) Rehabilitation and Extension Plan (N-1(1/4) Oltinsoy)

Rehabiliation Plan of Water Supply System

N-1-2	Rayon	**Nosiri-Khisrav**	Population (2007)	**900**	
Olzu	Jamoat	**Istiklol**	Population (2015)	**1080**	
	Village	**Olzu**			

Water Supply Plan

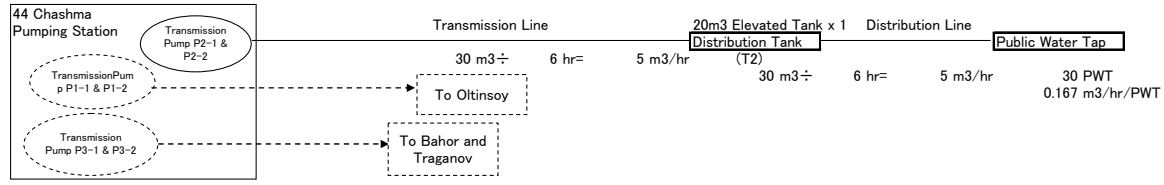
Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	22 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		0	
Institutional Water Demand	3 m3/day	5 m3/h		No. of Distribution Tank	
Total Water Demand	25 m3/day			20m3 Elevated Tank x 1	
Daily Average Flow	30 m3/day	Distribution Flow			
Daily Maximum Flow	30 m3/day	(=Daily Maximum Flow / Operation Hours) :		Public Water Tap	
Operation Hour	6 hr	5 m3/h		30 nos.	0.167 m3/h
Hourly Maximum Flow	5 m3/h				

Rehabilitation Plan

Water Source		Transmission Pump (Centrifugal Pump)			
Type of Water Source:		Type	380V x 3φ, 50Hz	No. of Pump:	2 pumps for duplex system (P2-1 and P2-2)
44 Chashma Pumping Station		Pump Head	54 m	Transformer	63 kw
(From Existing Waterwell and Reservoir)		Discharge Rate	5 m3/h		(1 Transformer for P1, P2 and P3)
Discharge Rate:	5 m3/h	Power	1.5 kw		

Distribution Tank	
No. of Tank	20m3 Elevated Tank x 1
Height of Tank	10 m

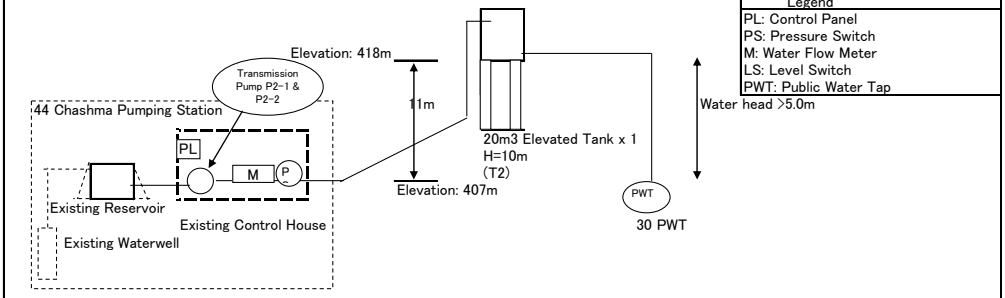
Water Supply Flow Chart



Population
1080

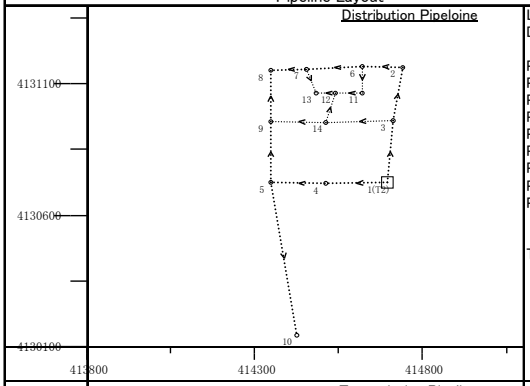
Distribution Flow
5m3/h

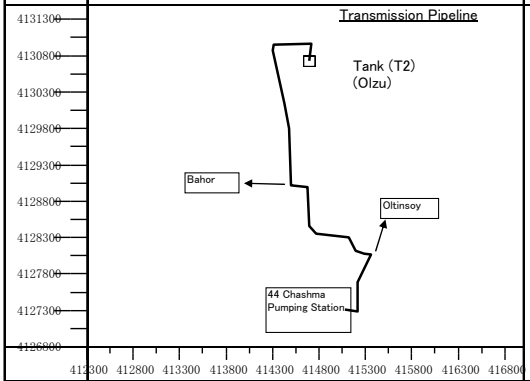
Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout





Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
● Waterwell
□ Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	814			814
PN75	61.4	2,192			2,192
PN90	73.6		5,127		5,127
PN110	90				
PN125	102.2				
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65				
SUS3″	75				
Total		3,006	5,127		8,133

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.15(2/4) Rehabilitation and Extension Plan (N-1(2/4) Olzu)

Rehabiliation Plan of Water Supply System

N-1-3	Rayon	**Nosiri-Khisrav**	Population (2007)	**3400**	
Bahor	Jamoat	**Istiklol**	Population (2015)	**4080**	
	Village	**Bahor**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	82 m3/day	(=Daily Maixmum Flow / Operation Housrs) :			0
Institutional Water Demand	12 m3/day	18.8 m3/h		No. of Distribution Tank	
Total Water Demand	94 m3/day				80m3 Semi-Underground Tank x 1
Daily Average Flow	113 m3/day	Distribution Flow			
Daily Maximum Flow	113 m3/day	(=Daily Maximum Flow / Operation Hours) :		Public Water Tap	
Operation Hour	6 hr	18.8 m3/h			91 nos. 0.207 m3/h
Hourly Maximum Flow	18.8 m3/h				

Rehabilitation Plan

Water Source

Type of Water Source:
44 Chashma Pumping Station
(From Existing Waterwell and Reservoir)
Discharge Rate: 26 m3/h

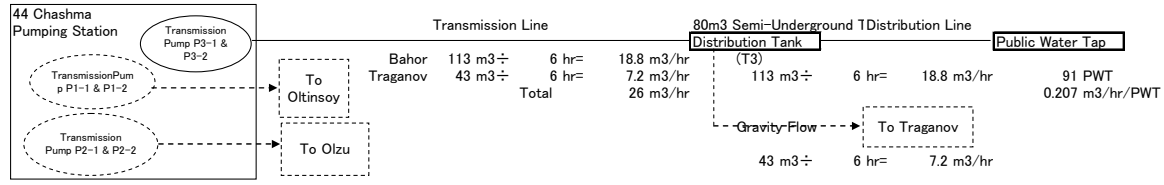
Transmission Pump (Centrifugal Pump)

Type	380V x 3φ, 50Hz	No. of Pump:	2 pumps for duplex system (P3-1 and P3-2)
Pump Head	83 m	Transformer	63 kw
Discharge Rate	26 m3/h		(1 Transformer for P1, P2 and P3)
Power	11 kw		

Distribution Tank

No. of Tank 80m3 Semi-Underground Tank x 1
Height of Tank 0 m

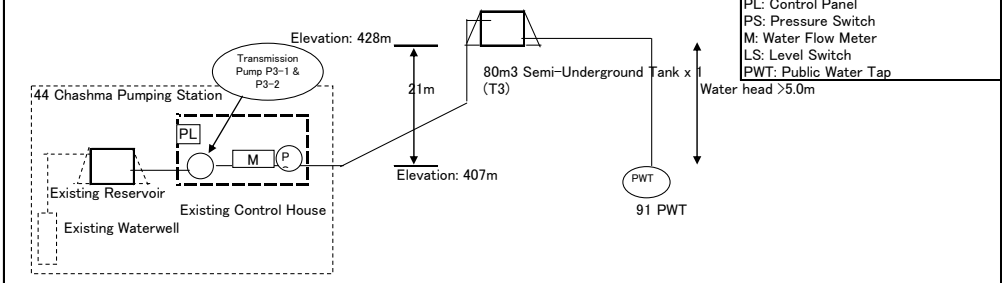
Water Supply Flow Chart



Population 4080

Distribution Flow 18.8m3/h

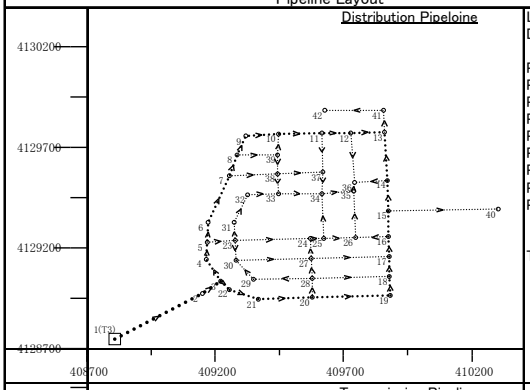
Unit Water Demand 20 L/day/capita



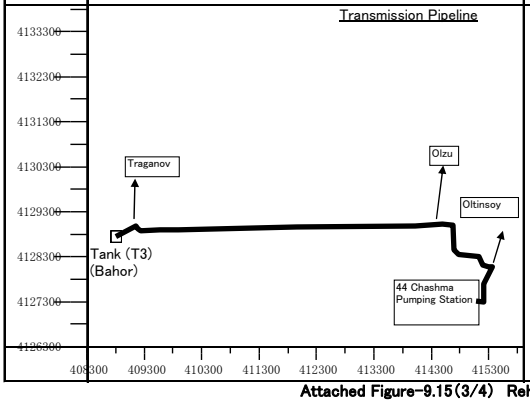
Legend
PL: Control Panel
PS: Pressure Switch
M: Water Flow Meter
LS: Level Switch
PWT: Public Water Tap

Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	5,753			5,753
PN75	61.4				
PN90	73.6	2,806			2,806
PN110	90				
PN125	102.2	505			505
PN140	114.6				
PN160	130.8				
PN180	147.2		8,336		8,336
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65				
SUS3″	75				
Total		9,064	8,336		17,400

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.15(3/4) Rehabilitation and Extension Plan(N-1(3/4) Bahor)

Rehabiliation Plan of Water Supply System

N-1-4	Rayon	**Nosiri-Khisrav**	Population (2007)	**1300**	
Traganov	Jamoat	**Istiklol**	Population (2015)	**1560**	
	Village	**44 Chashma – Oltinsoy**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	31 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		0	
Institutional Water Demand	5 m3/day	7.2 m3/h			
Total Water Demand	36 m3/day			No. of Distribution Tank	
Daily Average Flow	43 m3/day	Distribution Flow		30m3 Semi-Underground Tank x 1	
Daily Maximum Flow	43 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	7.2 m3/h		Public Water Tap	
Hourly Maximum Flow	7.2 m3/h			73 nos.	0.099 m3/h

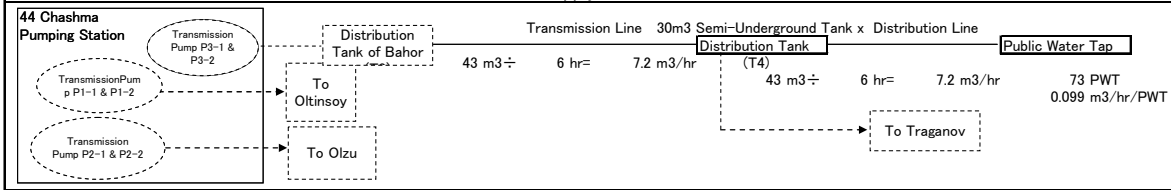
Rehabilitation Plan

Water Source	Type of Transmission
Type of Water Source: Distribution Tank in Bahor (From Existing Waterwell and Reservoir) Discharge Rate: 7.2 m3/h	Transmitted from Tank (T3) of Bahor to Tank (T4) of Traganov by gravity flow.

Distribution Tank

No. of Tank	30m3 Semi-Underground Tank x 1
Height of Tank	0 m

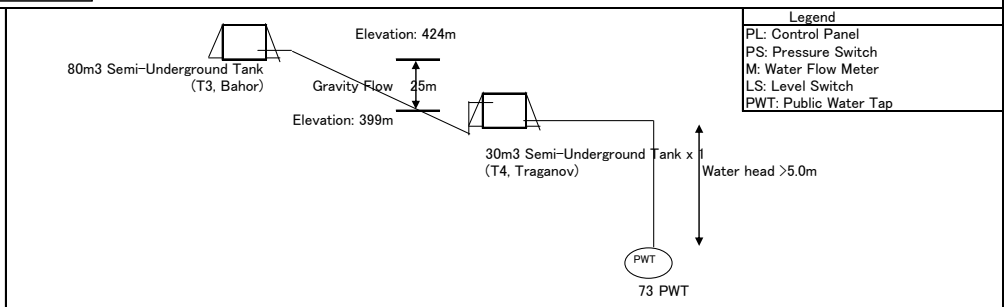
Water Supply Flow Chart



Population
1560

Distribution Flow
7.2m3/h

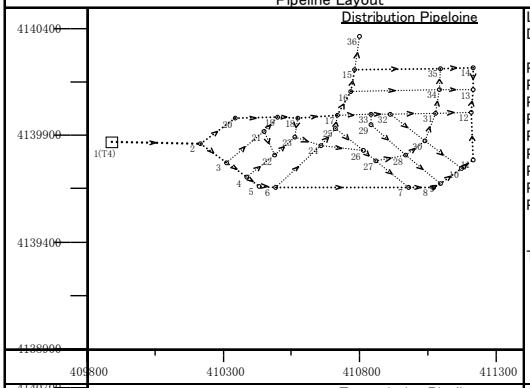
Unit Water Demand
20 L/day/capita



Legend
PL: Control Panel
PS: Pressure Switch
M: Water Flow Meter
LS: Level Switch
PWT: Public Water Tap

Distribution and Transmission Pipeline

Pipeline Layout

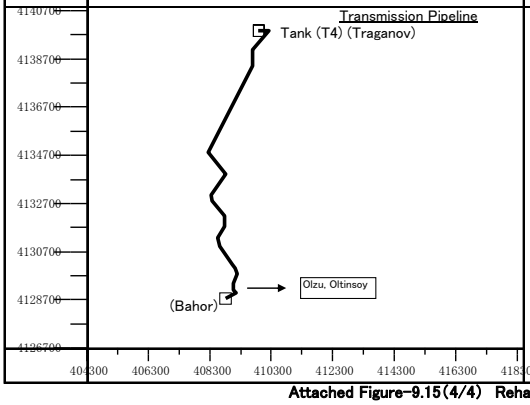


Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
● Waterwell
□ Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	4,242			4,242
PN75	61.4	2,762			2,762
PN90	73.6	325			325
PN110	90				
PN125	102.2		12,696		12,696
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65				
SUS3″	75				
Total		7,329	12,696		20,025

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe



Attached Figure-9.15(4/4) Rehabilitation and Extension Plan(N-1(4/4) Traganov)

Rehabiliation Plan of Water Supply System

S-4		Rayon	**Shakhritus**	Population (2007)	**5300**
Vatan		Jamoat	**Obshoron**	Population (2015)	**6360**
		Village	**Vatan**		

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	127 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		2	
Institutional Water Demand	19 m3/day	29.2 m3/h			
Total Water Demand	146 m3/day			No. of Distribution Tank	
Daily Average Flow	175 m3/day	Distribution Flow		90m3 Elevated Tank x 1	
Daily Maximum Flow	175 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	29.2 m3/h		Public Water Tap	
Hourly Maximum Flow	29.2 m3/h			63 nos.	0.463 m3/h

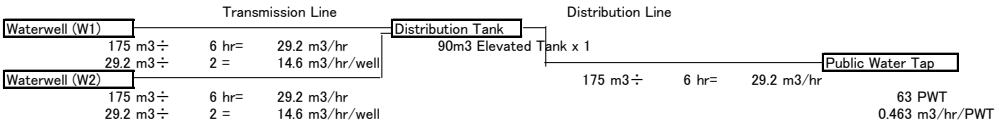
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	
Type of Water Source:	Waterwell	Type	380V x 3ϕ, 50Hz	Type	380V x 3ϕ, 50Hz
Well Capacity:	26.5 m3/h	Pump Head	57 m	Pump Head	57 m
Dyanamic Water Level:	20 m	Discharge Rate	14.6 m3/h	Discharge Rate	14.6 m3/h
Pump Instation Depth:	40 m	Power	3.7 kw	Power	3.7 kw
Well Depth:	80 m	Max. Diameter	131 mm	Max. Diameter	131 mm
Operation Hour:	6 hr	Transformer	25 kw	Transformer	25 kw
No. of Waterwell:	2 no.	Riser Pipe:	SUS	Riser Pipe:	SUS
Pumping Rate per well:	14.6 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	90m3 Elevated Tank x 1
Height of Tank	10 m

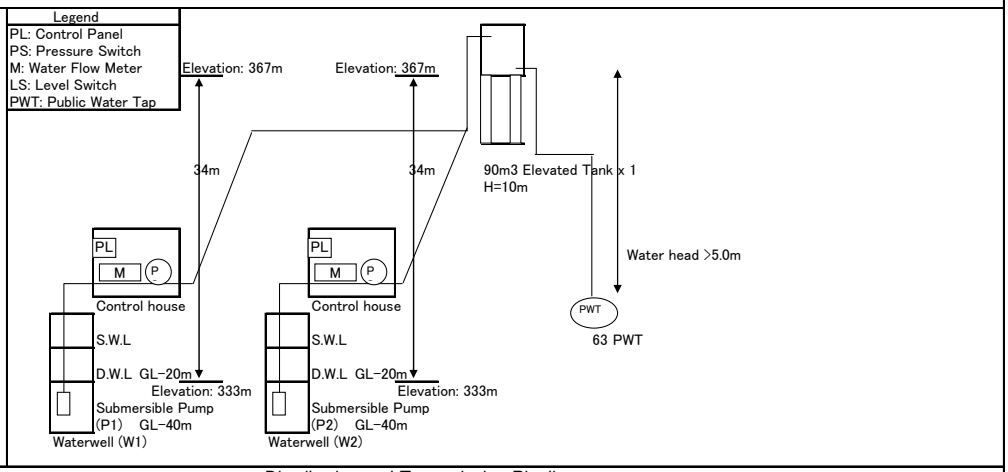
Water Supply Flow Chart



Population
6360

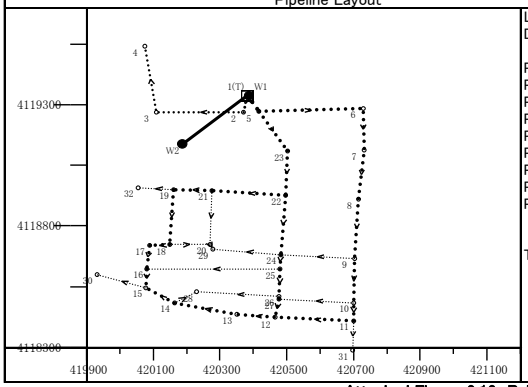
Distribution Flow
14.6m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
● Waterwell
□ Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	2,124			2,124
PN75	61.4				
PN90	73.6	534			534
PN110	90	68			68
PN125	102.2	3,514			3,514
PN140	114.6	75			75
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65				
SUS3″	75				
Total		6,315			6,315

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.16 Rehabilitation and Extension Plan(S-4 Vatan)

Rehabiliation Plan of Water Supply System

S-5-1		Rayon	**Shakhritus**	Population (2007)	**3750**
Sultanabod		Jamoat	**Pakhtabod**	Population (2015)	**4500**
		Village	**Sultanabod**		

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	90 m3/day	(=Daily Maixmum Flow / Operation Housrs) :			1
Institutional Water Demand	14 m3/day		20.8 m3/h		
Total Water Demand	104 m3/day			No. of Distribution Tank	
Daily Average Flow	125 m3/day	Distribution Flow			70m3 Elevated Tank x 1
Daily Maximum Flow	125 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr		20.8 m3/h	Public Water Tap	
Hourly Maximum Flow	20.8 m3/h				112 nos. 0.186 m3/h

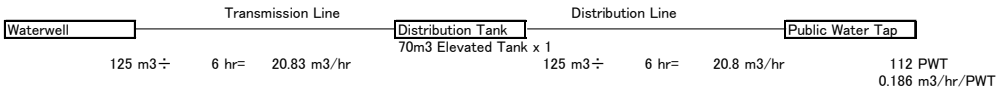
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	100 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	20.8 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	9.2 kw	Power	Power
Well Depth:	80 m	Max. Diameter	142 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	63 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	20.8 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	70m3 Elevated Tank x 1
Height of Tank	10 m

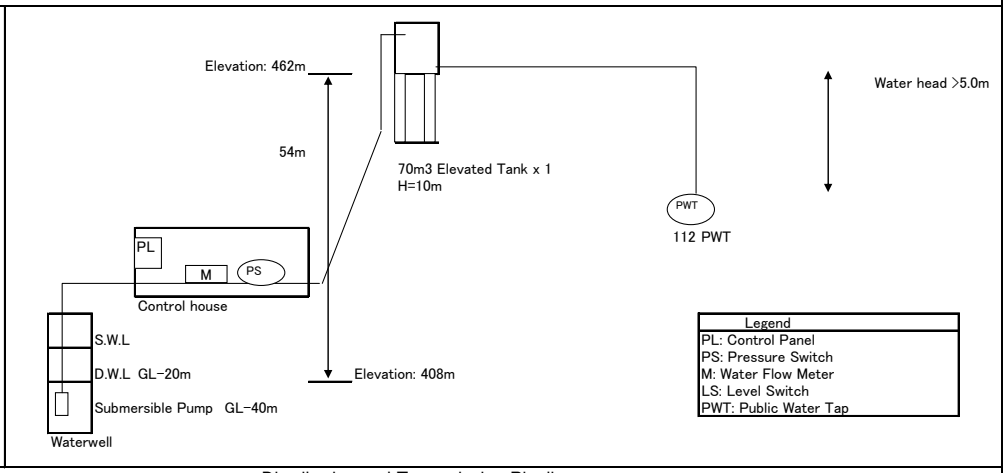
Water Supply Flow Chart



Population
4500

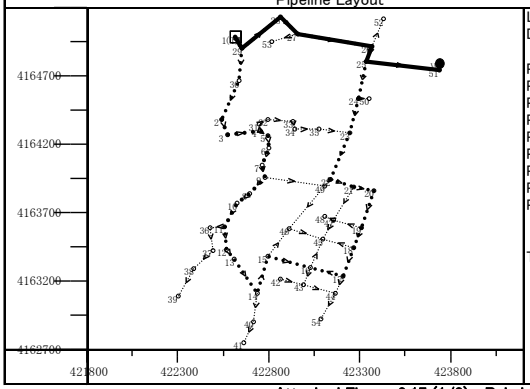
Distribution Flow
20.8m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	5,470			5,470
PN75	61.4				
PN90	73.6				
PN110	90				
PN125	102.2	4,557			4,557
PN140	114.6	1,095	1,564		2,659
PN160	130.8	93			93
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			40	40
SUS3″	75				
Total		11,215	1,564	40	12,819

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.17 (1/2) Rehabilitation and Extension Plan (S-5(1/2) Sultanabod)

Rehabiliation Plan of Water Supply System

S-5-2	Rayon	**Shakhritus**	Population (2007)	**2315**	
Yangabod	Jamoat	**Pakhtabod**	Population (2015)	**2778**	
	Village	**Sultanabod**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	56 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	8 m3/day	12.8 m3/h			
Total Water Demand	64 m3/day			No. of Distribution Tank	
Daily Average Flow	77 m3/day	Distribution Flow		40m3 Elevated Tank x 1	
Daily Maximum Flow	77 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	12.8 m3/h		Public Water Tap	
Hourly Maximum Flow	12.8 m3/h			91 nos.	0.141 m3/h

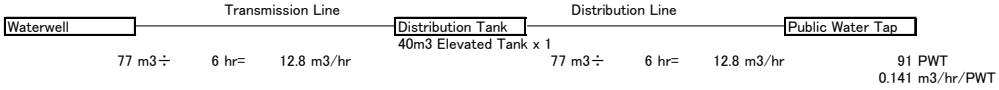
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	83 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	12.8 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	5.5 kw	Power	Power
Well Depth:	80 m	Max. Diameter	98 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	12.8 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	40m3 Elevated Tank x 1
Height of Tank	10 m

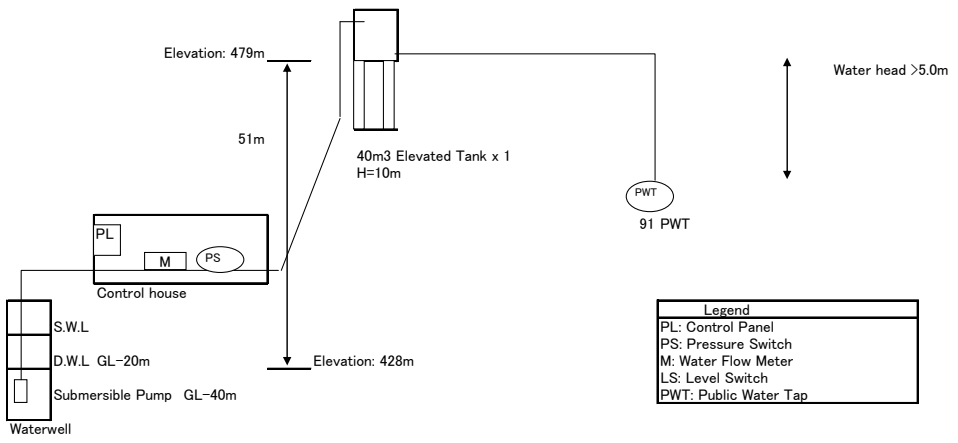
Water Supply Flow Chart



Population
2778

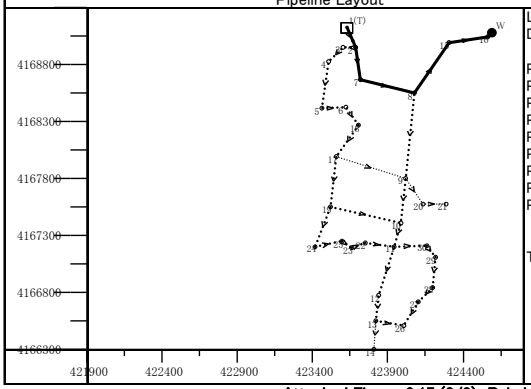
Distribution Flow
12.8m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	1,916			1,916
PN75	61.4				
PN90	73.6	7,014			7,014
PN110	90		1,669		1,669
PN125	102.2	183			183
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50			40	40
SUS2-1/2″	65				
SUS3″	75				
Total		9,113	1,669	40	10,822

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.17 (2/2) Rehabilitation and Extension Plan (S-5(2/2) Yangabod)

Rehabiliation Plan of Water Supply System

S-9-1	Rayon	**Shakhritus**	Population (2007)	**2642**	
Binokor	Jamoat	**Obshoron**	Population (2015)	**3170**	
	Village	**Binokor**			

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	63 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	9 m3/day	14.3 m3/h			
Total Water Demand	72 m3/day			No. of Distribution Tank	
Daily Average Flow	86 m3/day	Distribution Flow		40m3 Elevated Tank x 1	
Daily Maximum Flow	86 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	14.3 m3/h		Public Water Tap	
Hourly Maximum Flow	14.3 m3/h			53 nos.	0.27 m3/h

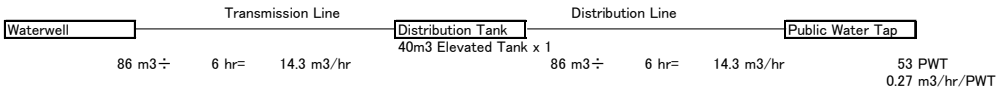
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	25 m3/h	Pump Head	55 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	14.3 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	3.7 kw	Power	Power
Well Depth:	80 m	Max. Diameter	98 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	14.3 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	40m3 Elevated Tank x 1
Height of Tank	10 m

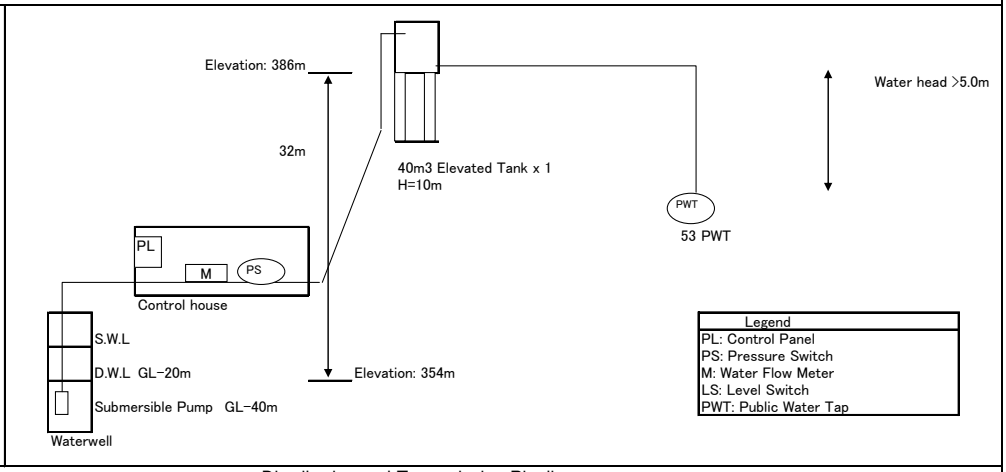
Water Supply Flow Chart



Population
3170

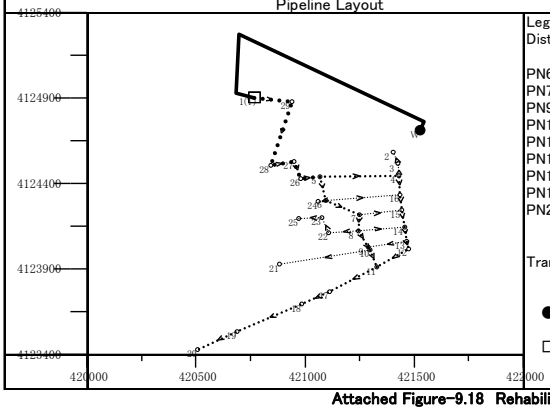
Distribution Flow
14.3m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	1,862			1,862
PN75	61.4				
PN90	73.6	2,566			2,566
PN110	90				
PN125	102.2		1,493		1,493
PN140	114.6	869			869
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50			40	40
SUS2-1/2″	65				
SUS3″	75				
Total		5,297	1,493	40	6,830

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.18 Rehabilitation and Extension Plan (S-9 Binokor)

Rehabiliation Plan of Water Supply System

P-13-1		Rayon	**Pyandzh**	Population (2007)	**2500**
Sarmantoy-1		Jamoat	**Sarmantoy**	Population (2015)	**3000**
		Village	**Sarmantoy**		

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	60 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	9 m3/day	13.8 m3/h			
Total Water Demand	69 m3/day			No. of Distribution Tank	
Daily Average Flow	83 m3/day	Distribution Flow		40m3 Elevated Tank x 1	
Daily Maximum Flow	83 m3/day	(=Daily Maximum Flow / Operation Hours) :			
Operation Hour	6 hr	13.8 m3/h		Public Water Tap	
Hourly Maximum Flow	13.8 m3/h			77 nos.	0.179 m3/h

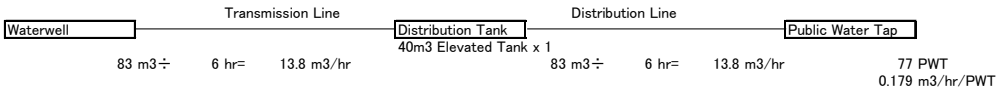
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	79 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	13.8 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	5.5 kw	Power	Power
Well Depth:	80 m	Max. Diameter	98 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	25 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	13.8 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	40m3 Elevated Tank x 1
Height of Tank	10 m

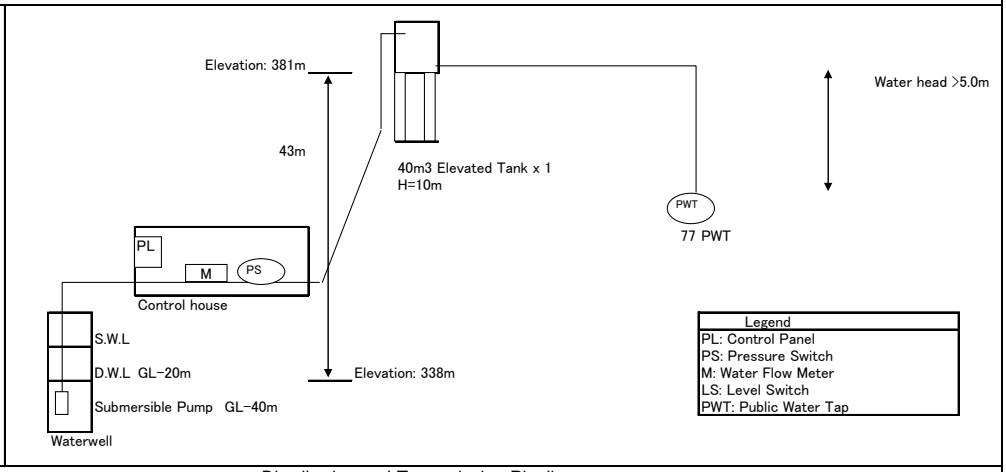
Water Supply Flow Chart



Population
3000

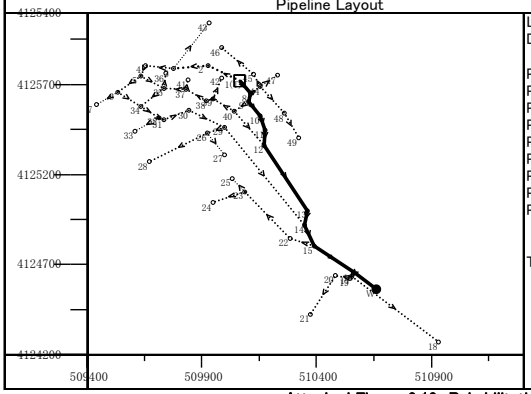
Distribution Flow
13.8m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	871			871
PN75	61.4	6,373			6,373
PN90	73.6	402			402
PN110	90				
PN125	102.2		1,384		1,384
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50			40	40
SUS2-1/2″	65				
SUS3″	75				
Total		7,646	1,384	40	9,070

PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.19 Rehabilitation and Extension Plan (P-13(1/2) SArmantoy-1)

Rehabiliation Plan of Water Supply System

P-13-2 **Sarmantoy-2**	Rayon Jamoat Village	**Pyandzh** **Sarmantoy** **Sarmantoy**	Population (2007) Population (2015)	**3400** **4080**	

Water Supply Plan

Water Demand	20 capita /day	Transmission Flow		No. of Waterwell	
Domestic Water Demand	82 m3/day	(=Daily Maixmum Flow / Operation Housrs) :		1	
Institutional Water Demand	12 m3/day	18.8 m3/h		No. of Distribution Tank	
Total Water Demand	94 m3/day			30m3 Elevated Tank x 1	
Daily Average Flow	113 m3/day	Distribution Flow			
Daily Maximum Flow	113 m3/day	(=Daily Maximum Flow / Operation Hours) :		Public Water Tap	
Operation Hour	6 hr	18.8 m3/h		41 nos.	0.459 m3/h
Hourly Maximum Flow	18.8 m3/h				

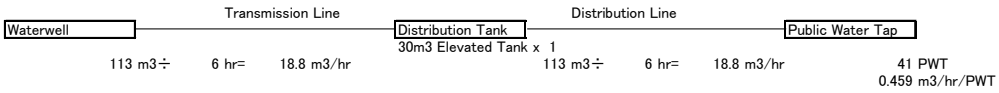
Rehabilitation Plan

Water Source		Well Pump 1		Well Pump 2	Well Pump 3
Type of Water Source:	Waterwell	Type	380V x 3φ, 50Hz	Type	Type
Well Capacity:	28 m3/h	Pump Head	42 m	Pump Head	Pump Head
Dyanamic Water Level:	20 m	Discharge Rate	18.8 m3/h	Discharge Rate	Discharge Rate
Pump Instation Depth:	40 m	Power	0 kw	Power	Power
Well Depth:	80 m	Max. Diameter	0 mm	Max. Diameter	Max. Diameter
Operation Hour:	6 hr	Transformer	0 kw	Transformer	Transformer
No. of Waterwell:	1 no.	Riser Pipe:	SUS	Riser Pipe:	Riser Pipe:
Pumping Rate per well:	18.8 m3/h				
Well Casing:	6″PVC				

Distribution Tank

No. of Tank	30m3 Elevated Tank x 1
Height of Tank	10 m

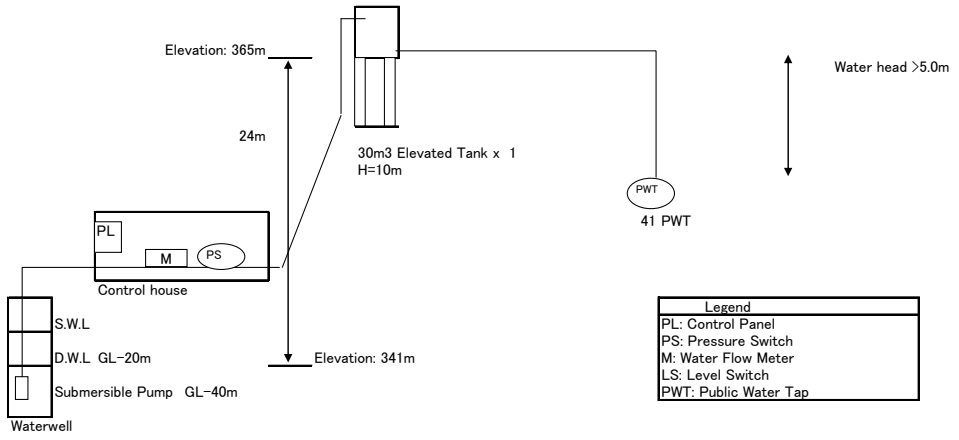
Water Supply Flow Chart



Population
4080

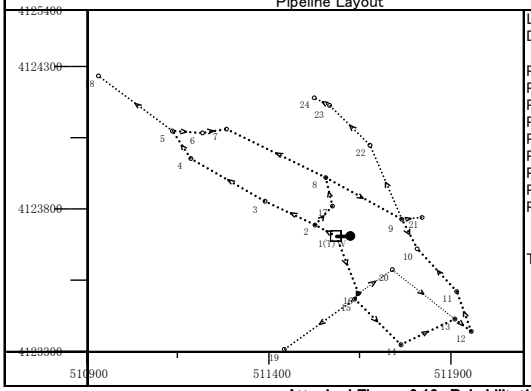
Distribution Flow
18.8m3/h

Unit Water Demand
20 L/day/capita



Distribution and Transmission Pipeline

Pipeline Layout



Legend:
Distribution PL
PN63
PN75
PN90
PN110
PN125
PN140
PN160
PN180
PN200
Transmission PL
Waterwell
Distribution Tank

Pipe Quantities

Pipe Type	Inside Diameter (m)	Distribution Pipeline (m)	Transmission Pipeline (m)	Pump Riser Main (m)	Total Length (m)
PN63	51.4	370			370
PN75	61.4	1,108			1,108
PN90	73.6	2,612			2,612
PN110	90				
PN125	102.2		44		44
PN140	114.6				
PN160	130.8				
PN180	147.2				
PN200	163.6				
SUS2″	50				
SUS2-1/2″	65			40	40
SUS3″	75				
Total		4,090	44	40	4,174

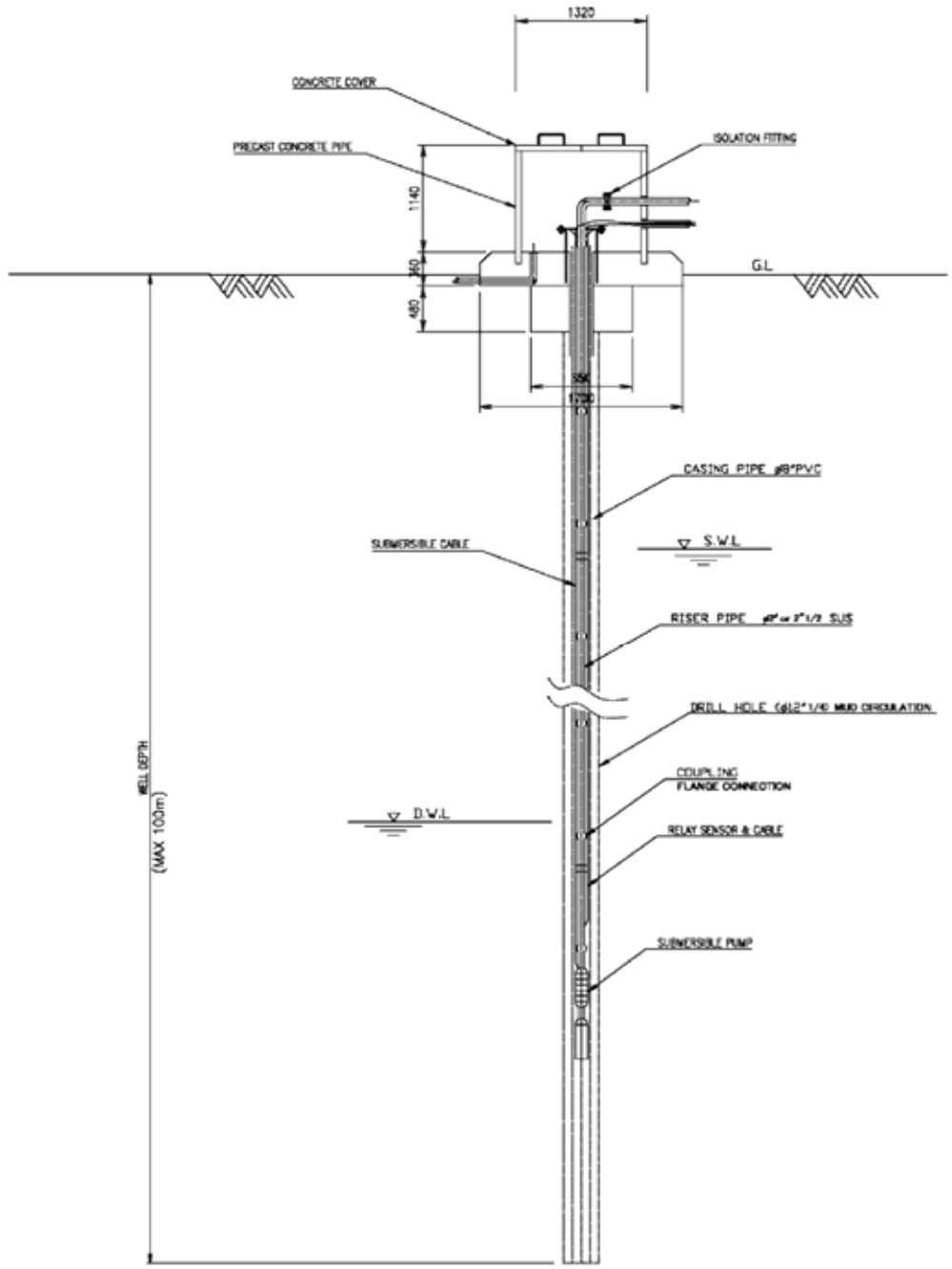
PN: Polyethylene Pipe
SUS: Stainless Steel Pipe

Attached Figure-9.19 Rehabilitation and Extension Plan (P-13(2/2) Sarmantoy-2)

4 CHAPTER 9 REHABILITATION AND EXPANSION PLAN OF RURAL WATER SUPPLY SYSTEM

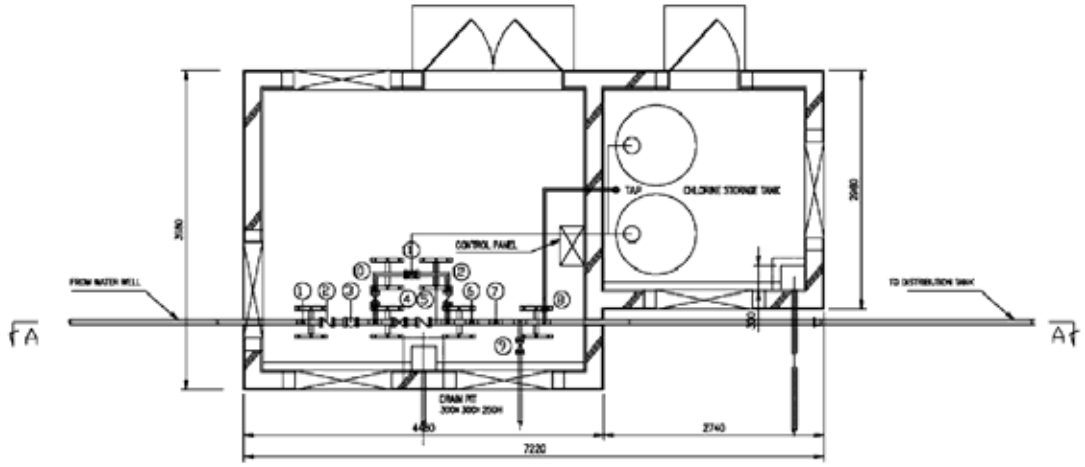
Attached Figures

(3) Design of Facility Structure

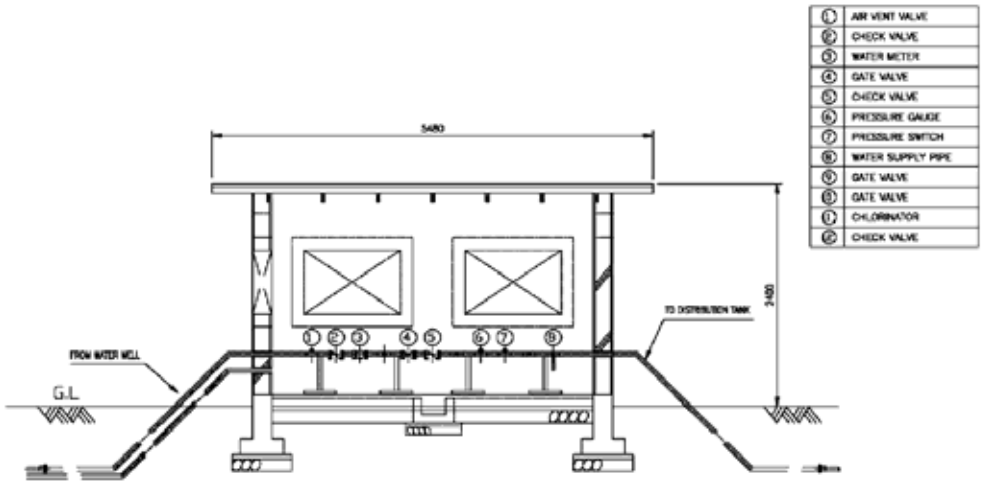


ATTACHED FIGURE 9.20 DESIGN OF BOREHOLE

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA



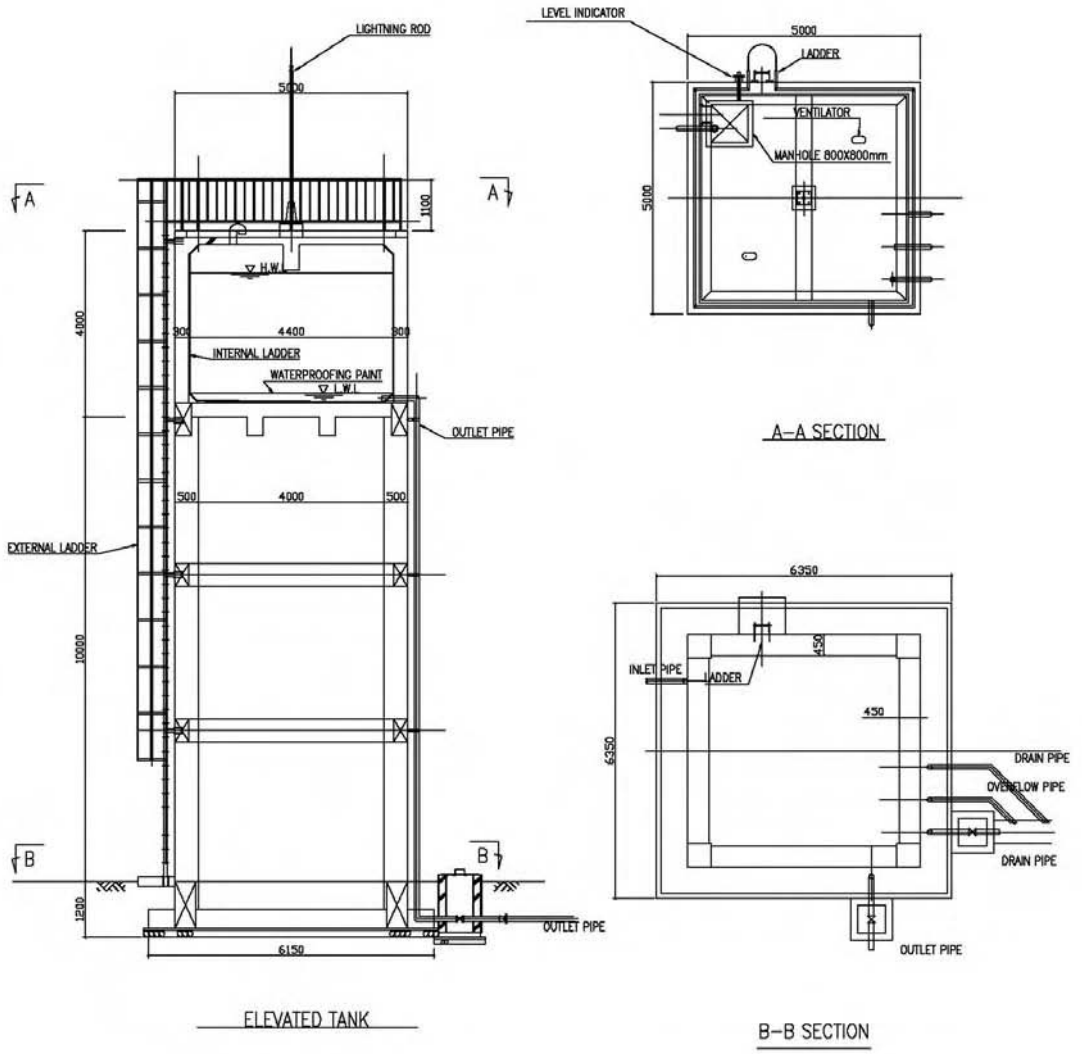
CONTROL HOUSE



A–A SECTION

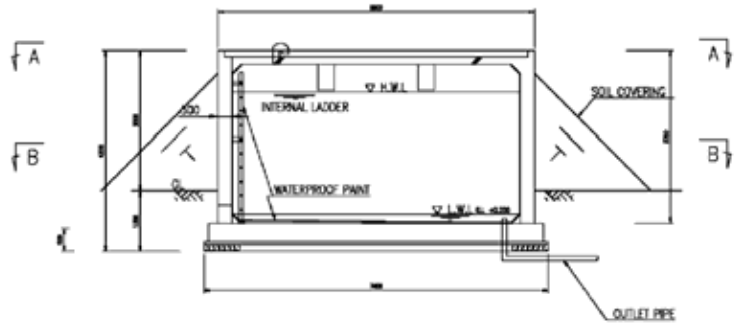
ATTACHED FIGURE 9.21 DESIGN OF CONTROL HOUSE

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	**JICA**

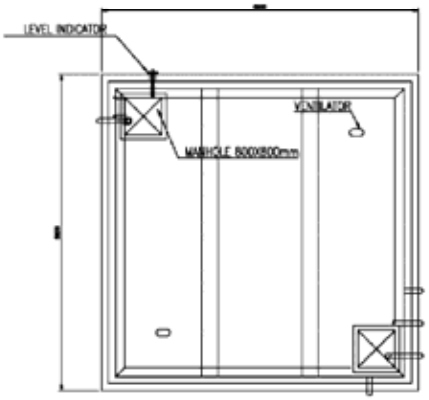


ATTACHED FIGURE 9.22 DESIGN OF ELEVATED WATER TANK (H=10M)

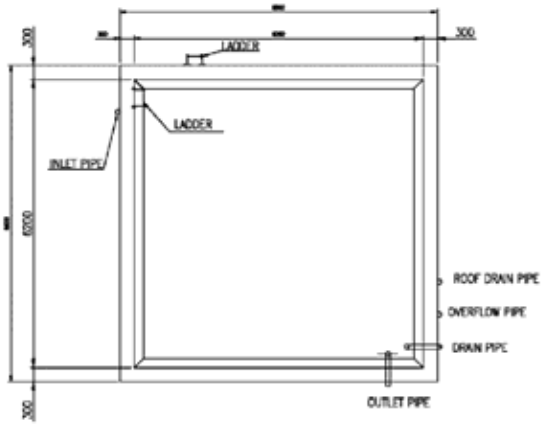
THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	**JICA**



SEMI-UNDERGROUND TANK (60m3)



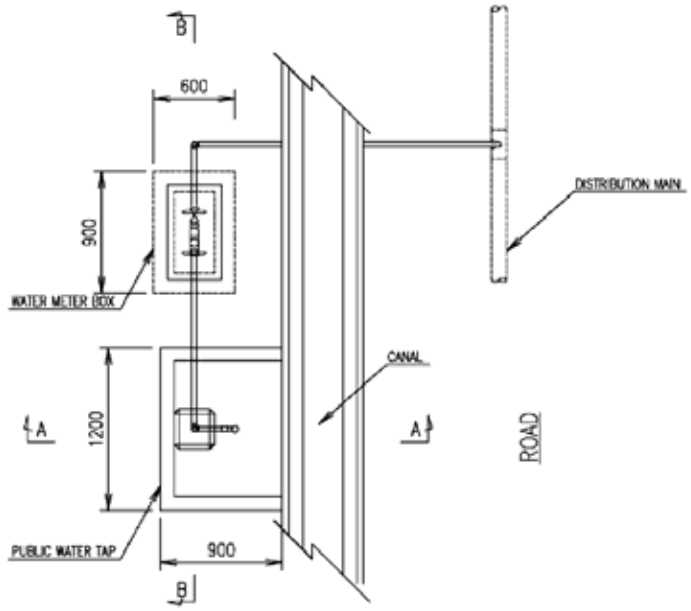
A-A SECTION



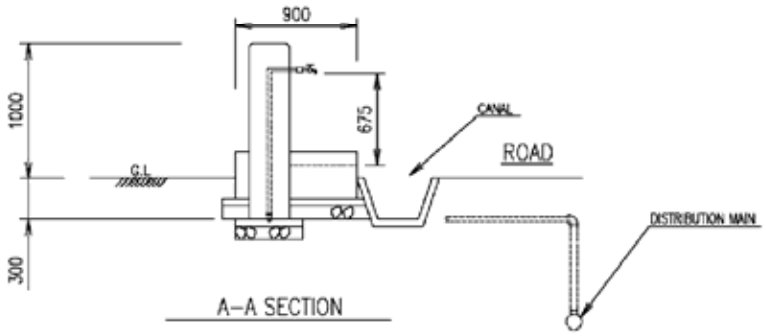
B-B SECTION

ATTACHED FIGURE 9.23 DESIGN OF SEMI-UNDERGROUND WATER TANK (60M^3)

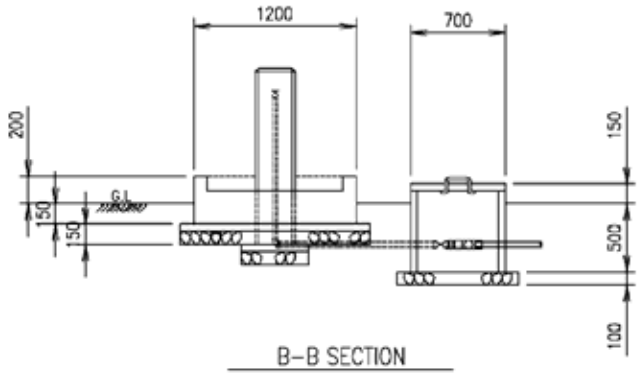
THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA



PUBLIC WATER TAP AND WATER METER BOX



A–A SECTION



B–B SECTION

ATTACHED FIGURE 9.24 DESIGN OF PUBLIC WATER TAP

THE STUDY FOR SUSTAINABLE RURAL WATER SUPPLY SYSTEM IN THE SOUTHERN KHATLON OBLAST, THE REPUBLIC OF TAJIKISTAN	JICA