Improvement of water supply services in the city of Samarkand, Uzbekistan

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ABSTRACT

Underground waters are the primary source of quality drinking water in the Uzbekistan and other Central Asian countries. It represents 85-90% of the general water budget. There are territories where underground water is the only source and the city of Samarkand is one of them.

The city of Samarkand is 2750 years old and with population 390000 which are almost to100 % connected to the communal water supply networks. Samarkand is supplied from two underground water well-fields, Chupan Ata and Dagbit both of the sources lie far outside of the city.

The drinking water supply network of the city of Samarkand is 700 km and about 41% of the network is older than 42 years and it requires replacement or comprehensive rehabilitation. Also there are vast number of illegal water users and treated water is being used for the irrigation systems in parks and agricultural purposes. One of the main issues in the water supply system is the significant water loss.

Samarkand water supply system needs to improve the safety, quality, reliability, efficiency and sustainability of the water supply services.

At the present the government of Uzbekistan working on Samarkand Water Supply project that totally could improve the situation in the city. Samarkand Water Supply project is being financed by the Republic of Uzbekistan, Samarkand water supply Utilities with a loan of IDA and IBRD.

Key words: Water supply, water sources, well rehabilitation, rational use, improvement

1. INTRODUCTION

Underground waters are the primary source of quality drinking water in the Uzbekistan and other Central Asian countries. It represents 85-90% of the general water budget. There are territories where underground water is the only source and the city of Samarkand is one of them.

The city of Samarkand is 2750 years old and have presently respectively some 390,000 inhabitants (383,000 according to present statistics) which are almost to 100% already connected to the communal water supply networks of Samarkand Vodokanal (SVK) or are expected to become connected during the next years.

The main objective is to improve the standard of water supply services in the city of Samarkand and to increase the efficiency of the existing system.

1.1. Water Production

The main water supply for Samarkand is provided from the Zaravshan River. The main well-fields of Chupan-Ata and Dagbit are directly located at the river bench. Other smaller well-fields as Bogibaland, Khimiki, Farkhad and Khichrau are located within and outside of the city boundary.

Samarkand receives app. 300.000 m3/d from the two well-fields Chupan-Ata and Dagbit which draw river bank filtrate. The well-fields are located about 4 to 6 km out of town along the river Zaravshan. East of Samarkand the river splits up into two arms which recombine again after several kilometers. The northern arm is called Akdarya the southern Karadarya. Both well-fields are located before the split, Chupan-Ata on the right side Dagbit on the left side.

The total number of production wells in operation in Samarkand amounts to 116 (82 in operation). All wells are in different state in their performance and use. The further utilisation of some of the wells might be critical for various reasons, such as physical condition of the well, existing pollution or

potential pollution of the water catchment area, risk for contamination, etc. With regard to visual inspection and operational experience the opinion that some of the wells lost the original capacity and other will most likely need to be abandoned for several reasons. The impact on the supply capacities of Samarkand Vodokanal needs to be analysed and, if necessary, alternatives for covering the total production demand need to be elaborated.

2. OBJECTIVES

The fundamental objective of this project is to undertake:

- a study on Samarkand water supply system;
- a study on well clogging issues in Samarkand;
- a study on Samarkand wellfield rehabilitation.
- Forecast of water demand for the design horizon (year 2025);
- To improve the standard of water supply services in the city of Samarkand and to increase the efficiency of the existing system.

2.1 Water Demand Forecast for next 25-year period as per General Plans of Samarkand City

The information given in General Plan for Samarkand (2005) would be the first document that will be taken into account in undertaking the water demand assessment for the Samarkand area. Samarkand city residents use approximately

- 300 liters per day per person
  (1200 liters per day per household)
- Suburb communities use approximately
  160 liters per day per person
- Farkhad, Khimiki, and Khishrau communities can use as much as
  150 liters per day per person

	1-2006	2-2010	3-2015	4-2020	5-2025	6-2030
Samarkand City	300	300	276	250	230	215
Suburb area	180	180	150	150	150	150
Surrounding villages	170	192	180	170	160	160

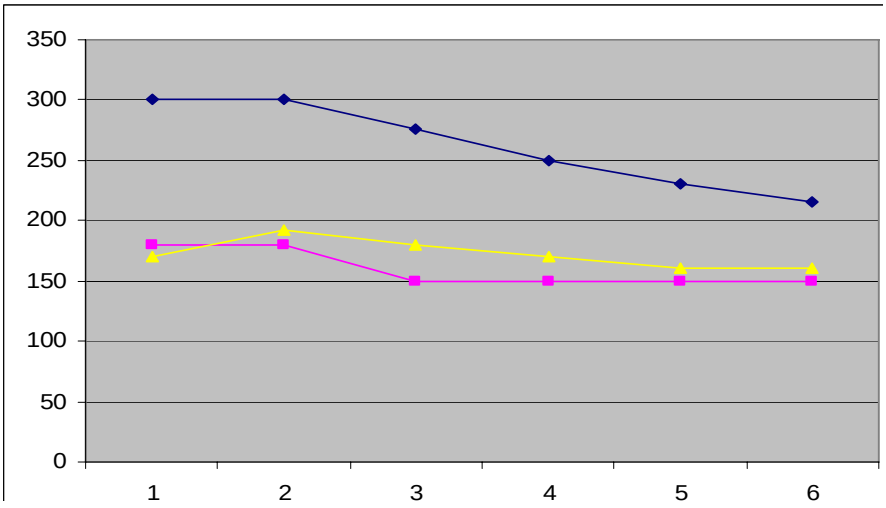

Figure 2. Water consumption forecast for Samarkand city, suburb area and surrounding villages

Water supply demand forecasts will be developed for a 25-year time horizon on a yearly basis, relying upon the above analysis and taking into account various policy scenarios applicable to the area. The demand forecast for 3 main scenarios, namely minimum, average and maximum level of population/ water demand. It is noted that there are vast number of illegal water users and treated water is being used for the irrigation systems in parks and agricultural purposes.

Forecasts in priority phases (I to IV) will also be split between residential, commercial, industrial and institutional uses in order to permit proper system sizing and allow income and any water subsidising issues to be addressed. Demand forecasts for residential use will be based upon per capita consumption, however, if possible household use will also be considered as a more reliable variable. Expected water losses in the reticulation network will be incorporated in the assessment.

3. Results

As outlined before, the two major well-fields of Chupan-Ata and Dagbit dispose of respectively 53 and 28 wells and almost 40% of them lost the original yield more than 50%.
The main reason for the decrease in efficiency of water wells is explained by the quality of underground waters and filling of water wells filters and near filter gravel zones with clogging deposits also with corrosion products of metallic elements of the water wells. The clogging deposits consists mainly salts calcium and iron oxides.

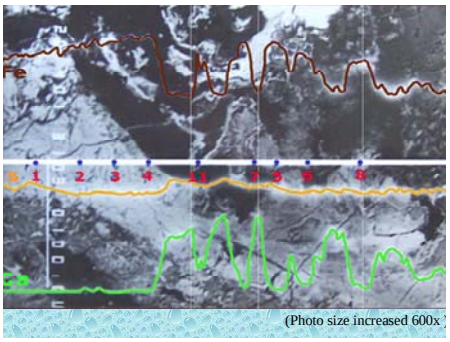

Figure 1. Results of X-ray analyses of salt clogging samples taken from Samarkand's water well filter

When wells lost more than 40 % productivity they need to be rehabilitated (restoring as a cleaning up filters and gravel zone).

The developed technology is combined (blended) as a chemical and impulsive. According this technology water wells could rehabilitated by using composition of selective solvent as a chemical and dry ice (solid carbon dioxide) as an agent for pressing of the selective solvent into aquafire.
The most important advantages of this technology are:

Composition of the selective solvent are environmentally safe;

Excellent penetration and high selectivity of reagents provides the greatest rehabilitation effect;

Using the dry ice provides pressure for pushing the solvent with a maximum penetration and partial dissolution of clogging salt depositions;

Water wells rehabilitation by using minimal amount of metallic corrosion allows prolongation the life of water wells with the metallic elements as a filter.

The combined water well rehabilitation technology is usable for any wells with different depths and allows a maximum restore the water wells capacity. Economic value of this technology equal to 15-20% from the overall value of construction of new wells.

Conclusions:

- The water supply system of the city of Samarkand is older than 42 years and it requires replacement or comprehensive rehabilitation.
- The two major well-fields of Chupan-Ata and Dagbit dispose of respectively 53 and 28 wells and almost 40% of them lost the original yield more than 50%.
- When wells lost more than 40 % productivity they need to be rehabilitated (restoring as a cleaning up filters and gravel zone). The developed technology is combined (blended) as a chemical and impulsive.
- Composition complexions containing the selective solvent are environmentally safe;
- Excellent penetration and high selectivity of complexions composition provides the greatest effect because complexionates of metals are easy to remove (to eliminate) after the treatment process;
- Treatment of water wells, by using minimal amounts of corrosive chemicals, allows prolongation of the life of water wells.
- A typical treatment time is 2-2.5 hours;
- The combined rehabilitation method can fully restore the water well capacity and economic value to equal 15-20% from overall value of construction of new wells.

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