WATER QUALITY AND WASTEWATER TREATMENT SYSTEMS IN GEORGIA

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Abstract. The paper considers water resources availability, quality and wastewater treatment systems in Georgia. The main pollution of water resources in the country comes from the municipal, industrial and agricultural sectors that cause pollution of water bodies by organic and inorganic matters, chemicals and toxins. The quality of surface water resources are low as a result of dumping of insufficiently treated and untreated sewage heavily urbanized areas. The main wastewater treatment plants in Georgia that discharge municipal sewerage to the Black Sea and Caspian Sea basins are in poor condition and do not operate well. Actions for sector improvement need to be feasible and focused on areas that can make a real difference in the future. Significant investment effort should be in the pipeline to improve situation in wastewater management sector, to provide monitoring on the quantity and quality of wastewater and renew of municipal wastewater plants.

Keywords: water availability, water quality, wastewater treatment systems, Republic of Georgia

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1. Introduction

Successful management of water resources is one of the most critical issues facing humanity. Clean and safe fresh water is vital for the life organisms, human health and ecosystem. It is also a central resource for economic and social development. Water security is indispensable for sustainable development.

Historically, water management has tended to compartmentalize the human relationship to water resources by considering each activity and use separately. Water for drinking, agricultural and industrial activities, navigation, fisheries and recreational use, for energy generation (hydropower plants) and environmental health has each been treated as distinct political, economic, or management issues[1].

One of the growing consensuses on how to achieve water security is through a proper use of water recourses and sufficient treatment of wastewater. This approach sets out a participatory planning and implementation process, based on sound science.

In the water supply and healthy environment sectors, the wastewater treatment, water conservation and hygiene play the vital role in improving healthy living environment.

2. Water Resources in the Republic of Georgia: Availability and Quality

2.1. WATER AVAILABILITY AND USE IN THE REPUBLIC OF GEORGIA

The Republic of Georgia is situated in the south-east of Europe and occupies a territory of approximately 70,000 km^2 with approximately 5 million populations. The length of Georgian frontier is 1,969 km. 32.2% of the territory is covered by forest, 10.9% by water bodies, and 39.6% by agricultural lands[2].

The rivers in Georgia are drained in two main drainage basins: the western part rivers drain into the Black Sea, and the eastern part rivers drain into the Caspian Sea. Georgia is abandoned by water resources and the amount of water discharged is about 820,000 tons per km^2 that is 2.5 times the world average. About 78 per cent of water resources are concentrated on the western area and only 22 per cent in the eastern area. The country's water stock is about 56.5 km^3 per year. Approximately 67 per cent of water resources are surface waters[3].

There are approximately 26,000 rivers in the country with total length of 59,000 km and about 860 lakes and reservoirs with total area of 170 km^2. Most of the rivers, approximately 93% of all rivers are less than 10 km long. The longest rivers of the country are: Alazani – 390 km (basin area – 12,000 km^2), Kura – 351 km (21,100 km^2), Rioni – 333 km (13,400 km^2), Enguri – 206 km

(4,100 km^2)[2]. The Kura River flows for more than 300 km through Georgia. The river basin is approximetly 15,000 km^2, or 23% of the country's territory. The biggest lakes are Paravan – with a 37.5 km^2 mirror area and Kartsakhi with 26.3 km^2.

Water supply in the country is at an average level, and a safe drinking water supply is the key component of the general objective to ensure the environmental safety and health of the people of Georgia.

The Rioni River is the largest tributary to the Black Sea in Georgia, draining approximately 20% of the country. Additional contributions to the Black Sea come from smaller rivers such as (moving southerly) the Enguri, Kodori, Supsa and Cholokhi. Drainage to the Caspian Sea is dominated by the Kura River[4] (known in Georgia as Mtkvari) (Table 1).

TABLE 1. General data of the major rivers of Georgia

River		Length, km	Basin area, m^2	Average Area, km^3	Basin height, m
Caspian	Alazani	390	12,000	3.1	1,900
Sea Basin	Kura	351	21,100	7.2	2,100
Black	Rioni	333	13,400	12.6	2,800
Sea Basin	Enguri	206	4,100	5.9	3,050

Source: Financing Strategy for the Urban Water Supply and Sanitation Sector in Georgia. EAP task force. 2004

The Kura-Araks river system is the principal source of water for industrial, agricultural, residential uses and hydropower plants in Armenia, Azerbaijan, Georgia, Iran and Turkey[5]. The rivers are important to regional cooperation in the region as they cross and form many of the borders. Both rivers are very seriously degraded. Water quality is seriously impaired by the dumping of untreated municipal, industrial, medical and agricultural wastes. The average amount of pollutants exceeds the established norms by 2 to 9 times and often represents a substantial threat to human health[6]. Various fragmented efforts applied on intergovernmental level by the country have not led significant improvement as it requires cooperation among of all the states involved in the initial pollution of the river waterbodies.

2.2. WATER QUALITY

Water quality is one of the major environmental concerns not only for Georgia, but also for the whole Southern Caucasus region. During the Soviet period, large volumes of effluents were discharged into surface water bodies from the municipal, industrial and agriculture sectors, causing pollution of both surface

and ground waters[7]. The sources of water pollution in the country were from the municipal wastewater, agricultural and industrial sectors. Municipal wastewater polluted rivers by the organic matters, suspended solids and surfactants. In the country large industrial facilities producing manganese, ammonia, arsenic, copper and gold mining, and processing plants, oil refineries and power plants polluted the river bodies of the Black and the Caspian Sea basins with heavy metals, oil products, phenols and other toxic substances (Figure 1). Also wastewaters from copper mining operations heavily polluted the Kazretula River (tributary of the Kura River) with heavy metals.

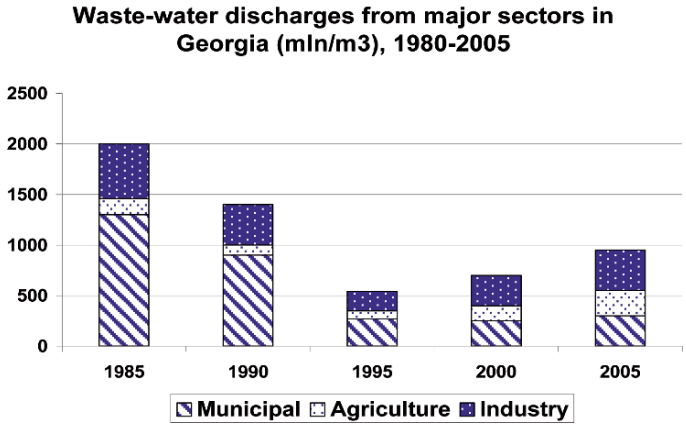

Figure 1. Caucasus Environment Outlook (CEO), 2002; Report of the Ministry of Environment and Natural Resources Protection of Georgia, 2005

After the break-up of the Soviet Union, contamination of surface waters has decreased, due to sharply decrease of industrial production and subsequent wastewater discharges. This could have resulted in the temporary improvement of water quality. However, this is off-set by the fact that the majority of waste-water treatment facilities ceased to function or work at very low levels of efficiency, caused the discharge of larger quantities of untreated wastewater directly into water bodies.

Data surface water quality in Georgia is extremely limited. The water quality in Georgia is collected by the Environmental Baseline Monitoring Center of the State Department of Hydrometeorology (Hydromet). According to the Hydromet, 131 sampling points are chosen in Georgia for baseline water quality monitoring in the rivers and reservoirs. Due to the lack of funding, only 26 points are monitored at regular basis (i.e., samples are taken and analyzed each month), another 26 at irregular basis (i.e., samples are taken and analyzed 2 or 3 times per year), and the remaining 70 points are not monitored at this

time. The collected data are provided by Hydromet to the Ministry of the Environment of Georgia[3]. The infrequency of monitoring, and questions as to the quality control on sample collection and analysis compared to international norms, complicates any ability to draw conclusions on true ecological health and threats to Georgian water resources. Based on published and unpublished data and qualitative interpretations by experts, the following tentative observations were drown:

- mostly ambient surface water quality exceeds Georgian (and comparable international) norms many times over throughout the main stems of both the Rioni and Kura rivers;
- as it is reported, the main stem of the Kura affected downstream from the cities of Borjomi, Gori, Tbilisi and Rustavi; Tributaries to the Kura of concern include the Vere River in the Tbilisi area, the Alazani River downstream from Telavi, the Mashavera River downstream from Madneuli, and the Suramula River downstream from Khashuri;
- also relatively greater impacts on the Rioni River are to downstream from Kutaisi and at Poti near the Black Sea;
- surface waters have high nutrient readings (especially ammonia) as a result from untreated discharges of municipal wastewater. Synthetic organic chemicals, oil products and metal contamination probably originate from industrial sources since only 10% of industrial discharge is treated;
- mainly groundwater quality is believed to be very good but essentially no data are available to support this claim. Data are insufficient to assess whether more vulnerable groundwater is being contaminated by municipal, agricultural or industrial pollution[8].

The quality of drinking water also is of particular concern. The Ministry of Labor, Health and Social Affairs has been able to maintain the minimum level of water system surveillance, though questions of quality control do arise, and this must be taken into account in interpreting official statistics. Test methods, especially for microbiological constituents, are not directly comparable to the World Health Organization (WHO) recommendations. Drinking water standards were set by the Ministry of Labor, Health and Social Affairs in August 2001, and were generally adapted from old Soviet norms. Despite these limitations, concerns over systems' violations are real. In total (and depending on data source), approximately 18% to 24% of samples collected from centralized water systems violated Georgian norms for chemical and microbiological constituents. Samples from 13 towns and cities exceeded microbiological norms by 50% or more. Except for the larger cities, monitoring by water utilities for even such basic parameters as disinfection residual is not carried out. Perhaps a more

direct measure of concern regarding drinking water is the occurrence of water-borne disease outbreaks.

3. Wastewater Management in the Republic of Georgia

3.1. WASTEWATER COLLECTION

Perhaps nowhere in Georgia is the decline in water sector investment and conditions as obvious as in the area of wastewater management. Wastewater collection systems operate in 41 cities and districts, 30 of which have wastewater treatment facilities with a total design capacity of 1.6 million m^3/day (including regional treatment facilities in Gardabani with a capacity of 1.0 million m^3/day, serving Tbilisi, Rustavi and Gardabani). All wastewater treatment facilities were designed and constructed as mechanical-biological treatment plants. The total length of the wastewater networks and sewers is 40,000 km^2.

In Georgia wastewater is collected through centralized municipal sewerage systems. At present none of the treatment facilities operates with the design capacity[9] (Table 2).

TABLE 2. Water supply and wastewater collection services in Georgia

City group	Covered by centralized water supply	Covered by centralized wastewater collection
Large cities (above 140,000 inhabitants)	100.0%	93.2%
Resort towns of the Black sea coastal zone	81.5%	32.3%
Other settlements	63.7%	28.7%

Source: Financing Strategy for the Urban Water Supply and Sanitation Sector in Georgia. EAP task force. 2004

3.2. WASTEWATER TREATMENT

Only 5 of the 23 municipal wastewater treatment plants are operating in the country currently, albeit at the reduced efficiency of mechanical mode. Biological treatment units (which are more effective at reducing organic and nutrient loading to surface water) are not operational at any of the 19 facilities. According to unpublished reports (prepared in 1999 for a possible donor grant), while the plant was initially designed to treat 1 million m^3 per day, only an estimated 600,000 m^3 per day passed through the plant. This reflected the fact that only 43 out of 100 connections to the sewer collectors had been actually

installed. The rest of the wastewater (estimates range from 30% to 50% of the total) from Tbilisi discharged directly to the Kura River without even rudimentary treatment. Some components within the treatment plant (such as the sludge digesters) had never been completed. Needed improvements to wastewater collection and treatment systems were extensive and encompassed all components[8].

All wastewater treatment facilities were constructed before 1990. The design technology is now outdated and does not comply with modern requirements, especially with regard to sludge treatment. Moreover, the technology relies on almost free electric energy and natural gas. The energy crisis which followed the dissolution of the Soviet Union, the significant electricity tariff increase and the lack of financing have negatively influenced almost all wastewater treatment facilities of the country. The technological processes were interrupted, the microorganisms used for biological treatment were lost, and pipes and conduits were clogged up[2] (Figure 2.).

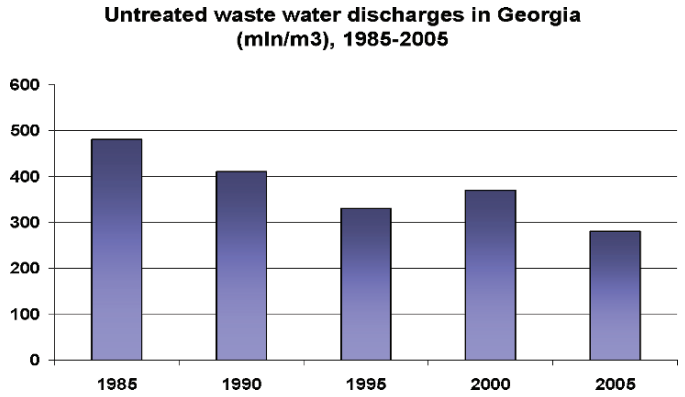

Figure 2. Source: Caucasus Environment Outlook (CEO), 2002; Report of the Ministry of Environment and Natural Resources Protection of Georgia, 2005

The condition of wastewater infrastructure in other settlements is rather lamentable: many facilities are being destroyed, and the equipment is completely worn out and partly lost. However, despite the difficulties related to the wastewater sector of Georgia, there are possibilities to treat wastewater and reconstruct treatment facilities. Regional treatment facilities in the Gardabani (serving Tbilisi, Rustavi and Gardabani) presently are reconstructed at the expense of Gruzvodocanal LLC with participation of the Association of Vodocanals of Georgia[3].

The situation regarding industrial wastewater reflects the extensive downturn in industrial production in the country. Water use, one measure of

productivity and pollution impact, dropped from a reported 1,542 million m^3 to 975 million m^3 from 1985 to 1992 and to 211 million m^3 in 1998. One of the principal industrial categories is food processing, which can generate organic contamination. Pretreatment of wastewater by the vast majority of industrial users is the exception rather than the rule. The Ministry of Environment and Natural Resources Protection of Georgia estimates that more than 80% to 90% of industrial wastewater is not treated before being discharged to sewers and municipal wastewater treatment plants (where there is a network), or directly to surface waters (where there is no network). If biological treatment units were in operation at municipal wastewater plants (which unfortunately they are not) pretreatment to neutralize metals, acids and other contaminants would be essential for good operation[8].

4. Conclusions and Recommendations

4.1. CONCLUSIONS

Georgia is rich by ground and surface waters, but the infrastructure and management systems are currently in a place to use these resources effectively and in sustainable way. More than 80% of urban wastewater systems fail to provide even the most rudimentary treatment. Water utilities are unsuccessful at raising sufficient revenue from water tariffs to meet even basic operating expenses for energy and treatment chemicals. Given the expense of treatment chemicals and the high cost of energy faced by water utilities, it is reported that 70% of utilities do not disinfect their water supplies. The majority of wastewater utilities have not performed the required routine repair and restoration work for a long period of time[8].

The most dramatic situation exists in the domestic and industrial sewage collection and treatment systems. The majority of wastewater treatment plants are not operating well, and therefore wastewater discharges without treatment into open water bodies. This causes pollution of rivers, the Black and Caspian Seas. Such contamination of water resources has become the main reason for mass intestinal and infectious diseases in Georgia.

Given the scope of these difficulties and serious budget constraints in the country, recommendations for sector improvement need to be both feasible and focused on areas that can make a real difference in the near to mid term.

Investments are needed to reduce water losses, eliminate cross-connections with wastewater collectors, and improve cost-recovery through water metering and other means.

Donor assistance could be used to finance infrastructure investments with the greatest health benefit, for example disinfection technologies and strengthening of surveillance laboratories.

Nevertheless, cooperation with industrial sub-sectors that are relatively more viable economically can set the stage for broader improvements in the future.

4.2. RECOMMENDATIONS FOR THE IMPROVEMENT OF WASTE WATER TREATMENT SYSTEMS (WWTS)

- The Ministry of Environment and Natural Resources Protection of Georgia, in cooperation with other relevant ministries, should begin long-term strategic planning both at the national and at the utilities level the problems of wastewater management through the launching of a wastewater program for the most urgent hot spots;
- The agencies which are responsible for developing and implementing the wastewater treatment programs should start regulating this sector, developing sector investment programs and mobilizing resources for their implementation (budgetary funding and/or external loans and grants), practically to address these tasks;
- Support the establishment and strengthening of water-sector institutions, improve water quantity and quality indicators, enforcement of wastewater regulations, and promote legal and policy reforms in the country would be a positive sign for overall sector reform;
- To strengthen the involvement of the private sector in the provision of water and wastewater services in Georgia to renew and rebuilt the system of wastewater collectors that the majority of wastewater treatment facilities start to function at high levels of efficiency.

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